

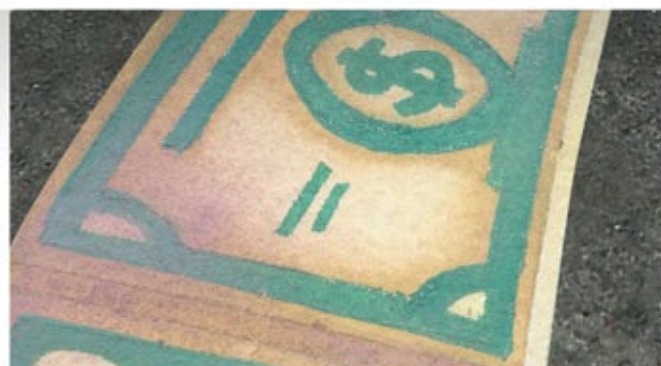


NOVEMBER 2011

CAREER CLUSTERS

FORECASTING DEMAND FOR
HIGH SCHOOL THROUGH
COLLEGE JOBS

2008–
2018



GEORGETOWN UNIVERSITY
Center
on Education
and the Workforce

Anthony P. Carnevale
Nicole Smith

NRC CTE
National Research
Center for Career and
Technical Education

James R. Stone, III
Pradeep Kotamraju

Learning that works for America
CTE

Bruce Steuernagel
Kimberly A. Green

**The views expressed in this publication are those of the authors
and do not necessarily represent those of Lumina Foundation,
the Bill and Melinda Gates Foundation, or the
U.S. Department of Education, their officers, or employees.**

CAREER CLUSTERS

FORECASTING DEMAND FOR
HIGH SCHOOL THROUGH
COLLEGE JOBS

**2008–
2018**

Contents

III Acknowledgments

V Illustrations

10 1: Key Messages

14 2: Earning Middle-Class Wages: Career Clusters and the MET

- Opportunities for those with a high school diploma or less still exist but are quickly declining.
- Jobs for high school graduates and dropouts are concentrated in four career clusters.
- The best opportunities for high school dropouts or high school graduates are in male-dominated fields.
- Although some high school jobs exceed the Minimum Earnings Threshold (MET), these jobs are declining.
- Women need postsecondary education to earn wages that men with a high school diploma earn.
- Some middle-skills jobs exceed the MET.
- Postsecondary education increases opportunity and access.
- Jobs for workers with some college/no degree or an Associate's degree are concentrated in six career clusters (compared to four for workers with a high school diploma or less).
- A Bachelor's degree or better guarantees access to all career clusters.
- A Bachelor's degree or better offers accessibility to all high-paying jobs within career clusters, but it is not a guarantor. Occupation matters.
- Most jobs for workers with a Bachelor's degree or better pay wages exceeding the MET.

38 3: FORECASTING EMPLOYMENT DEMAND BY CAREER CLUSTER

- Current supply of secondary and postsecondary CTE graduates by career cluster

46 4: LOOKING FORWARD TO 2018: EMPLOYMENT PROJECTIONS FOR CTE

- Size, educational characteristics, and trends in employment in CTE career clusters

66 5: EXAMINING WAGES AND CAREER CLUSTERS

- There is a wide distribution of wages across career clusters.
- Across time, wage growth is best in Business, Management, and Administration; Finance; Health Science; Information Technology; and Law, Public Safety, Corrections, and Security.
- Occupation matters.
- STEM and Information Technology are the best-paying career clusters for middle skills.
- The gender wage gap by career cluster ranges between \$2,000 and \$69,000.
- Disaggregating by career cluster and age reveals occupational bias in the gender wage gap.
- High-Demand Versus High-Wage Jobs

81 6: FORECASTING DEMAND CLUSTER BY CLUSTER THROUGH 2018

- Career Cluster 1: Agriculture, Food, and Natural Resources
- Career Cluster 2: Architecture and Construction
- Career Cluster 3: Arts, A/V Technology, and Communications
- Career Cluster 4: Business, Management, and Administration
- Career Cluster 5: Education and Training
- Career Cluster 6: Finance
- Career Cluster 7: Government and Public Administration
- Career Cluster 8: Health Science
- Career Cluster 9: Hospitality and Tourism
- Career Cluster 10: Human Services
- Career Cluster 11: Information Technology
- Career Cluster 12: Law, Public Safety, Corrections, and Security
- Career Cluster 13: Manufacturing
- Career Cluster 14: Marketing, Sales, and Service
- Career Cluster 15: STEM (Science, Technology, Engineering, and Mathematics)
- Career Cluster 16: Transportation, Distribution, and Logistics

Acknowledgments

We would like to express our gratitude to the individuals and organizations that have made this report possible. First, we thank Lumina Foundation and the Bill and Melinda Gates Foundation for their support of our research over the past few years, and in particular, we are grateful for the support of Jamie Merisotis, Hilary Pennington, Holly Zenville, Parminder Jassal, and Ann Person. We are honored to be partners in their mission of promoting postsecondary access and completion for all Americans.

Acknowledgments

Although the analysis, conclusions, and recommendations in this report should be viewed as the responsibility of the authors, the content has benefited enormously from assistance from others. We would like to thank the following members of the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) for their area-matter expertise and early comments on the content of the report:

- John Fischer, State Director of Career & Technical Education, Vermont Department of Education;
- Katherine M. Oliver, Assistant State Superintendent, Career Technology and Adult Learning, Maryland Department of Education;
- Mark Williams, Division Administrator, Career Development Division, Illinois State Board of Education.

We thank Stephanie Soutouras Schlick for editing the report, and research analyst Michelle Melton and program coordinator Laura Meyer for their early compilation and coordination for the layout and printing of the report.

We also wish to thank the following staff members of the Association of Career and Technical Education—Pete Magnuson, Lauren Schultz and Kirsten Sundell of the National Research Center for Career and Technical Education (NRCCTE) for critiquing content and facilitating printing and design.

Figures

1. Percent earning more than \$35k (2010\$).
2. Most new and replacement jobs will be in Hospitality and Tourism.
3. Prime-age workers earn above-average wages in STEM jobs (2009\$).
4. Seven career clusters experienced above-average real wage growth between the 1980s and the 2000s.
5. Education still determines wages, but occupation matters.
6. The gender wage gap is largest in Finance and Health Science.
7. Gender wage gap by career cluster
8. Women younger than 30 earn about 83 percent as much as men.
9. Wage differential by career cluster, age, and sex for full-time, full-year workers.
10. The national average for employment in Agriculture, Food, and Natural Resources is roughly 4 percent and declining.
11. About one-half of all jobs in Agriculture, Food, and Natural Resources will require postsecondary education and training by 2018.
12. Almost 10 percent of jobs in Architecture and Construction were lost between 2007 and 2008.
13. A little more than one-third of jobs in Architecture and Construction will require postsecondary education and training by 2018.
14. Jobs in Arts, A/V Technology, and Communications are expected to grow by 15 percent between 2008 and 2018.
15. Almost 80 percent of jobs in Arts, A/V Technology, and Communications will require postsecondary education by 2018.
16. Jobs in Business, Management, and Administration are projected to grow by 6 percent between 2008 and 2018.
17. More than one-third of jobs in Business, Management, and Administration will require a Bachelor's degree or better by 2018.
18. Jobs in Education and Training will increase by 14 percent through 2018 despite cuts in benefits, pay, and staffing.
19. Almost 80 percent of jobs in Education and Training will require a Bachelor's degree or better by 2018.
20. Jobs in Finance are projected to grow by 10 percent between 2008 and 2018 despite the loss of about 200,000 jobs between 2008 and 2009.
21. Fifty-seven percent of jobs in Finance will require a Bachelor's degree or better by 2018.
22. Jobs in Government and Public Administration will be affected by budget constraints well into the future.
23. More than one-third of jobs in Government and Public Administration will require a Bachelor's degree or better by 2018.
24. Jobs in Health Science — the fastest-growing career cluster — are projected to grow by 23 percent between 2008 and 2018.
25. Almost half of jobs in Health Science will require a Bachelor's degree or better by 2018.
26. Jobs in Hospitality and Tourism are projected to grow by 12 percent between 2008 and 2018; however, many jobs are entry-level, seasonal, and part-time.
27. More than one-third of jobs in Hospitality and Tourism will require postsecondary education and training by 2018.
28. Jobs in Human Services are projected to grow by 19 percent by 2018. This is one of few career clusters that added jobs during the recession.
29. More than two-thirds of jobs in Human Services will require postsecondary education by 2018.
30. Jobs in Information Technology are projected to grow by 23 percent between 2008 and 2018, demonstrating the career cluster's influence on every facet of industry and job requirements.
31. More than 70 percent of jobs in Information Technology will require a Bachelor's degree or better by 2018.
32. Jobs in Law, Public Safety, Corrections, and Security are projected to grow by 14 percent between 2008 and 2018, but the career cluster will face the same budget constraints affecting local and state governments.

33. More than 80 percent of jobs in Law, Public Safety, Corrections, and Security will require postsecondary education and training by 2018.
34. Jobs in Manufacturing will decline in number between 2008 and 2018, but about 2 million jobs will become available as baby boomers retire.
35. More than 40 percent of jobs in Manufacturing will require postsecondary education by 2018.
36. Jobs in Marketing, Sales, and Service are projected to grow by 11 percent between 2008 and 2018.
37. Nearly 60 percent of jobs in Marketing, Sales, and Service will require postsecondary education by 2018.
38. Jobs in STEM are projected to grow by 9 percent between 2008 and 2018.
39. Almost 70 percent of jobs in STEM will require a Bachelor's degree or better by 2018.
40. Jobs in Transportation, Distribution, and Logistics are projected to grow by little more than 4 percent between 2008 and 2018, 6 percentage points below the national average.
41. About 45 percent of jobs in Transportation, Distribution, and Logistics will require only a high school diploma and on-the-job training in 2018.
5. Workers with high school diplomas working as food service managers in Hospitality and Tourism earn wages just below the MET.
6. Middle-skill workers in Marketing, Sales, and Service can earn wages above the MET.
7. Middle-skill workers in Manufacturing can earn wages above the MET.
8. Middle-skill workers in Transportation, Distribution, and Logistics can earn wages above the MET.
9. Middle-skill workers in Health Science can earn wages above the MET.
10. Middle-skill workers in Business, Management, and Administration can earn wages above the MET.
11. Middle-skill workers in Hospitality and Tourism can earn wages close to or above the MET.
12. The best opportunities to earn a living wage with middle skills are concentrated in six career clusters.
13. Seventy-two percent of all jobs for college degree holders will be in nine career clusters.
14. College-level workers in Business, Management, and Administration earn wages well above the MET in managerial positions.
15. College-level workers in Education and Training can earn wages above the MET in a number of occupations.
16. College-level workers in Finance commonly earn wages well above the MET.
17. College-level workers in most Government and Public Administration occupations commonly earn wages well above the MET.
18. College-level workers in Health Science earn wages above the MET in a number of growing occupations.
19. College-level workers in Hospitality and Tourism can earn wages above the MET as food service managers.
20. College-level workers in many Information Technology jobs earn wages well above the MET.

Tables

1. The best opportunities to earn a living wage with less than high school or high school diplomas are concentrated in career clusters where men dominate.
2. The best paying opportunities for women in middle skill jobs pay less than the best paying opportunities for men with less than high school or a high school diploma.
3. Workers with high school diplomas in Architecture and Construction can earn wages above the MET.
4. Workers with high school diplomas working in Transportation, Distribution, and Logistics earn wages above the MET.

Illustrations

21. College-level workers in Marketing, Sales, and Service can earn the most as supervisors, sales representatives and market research analysts.
22. College-level workers in STEM can earn high wages, especially as engineering managers.
23. Participation and concentration of workers with a high school diploma and postsecondary middle skills in CTE, completion by diploma or degree and career cluster
24. Participation and concentration of workers with a high school diploma and postsecondary middle skills in CTE, ranking of diploma or degree totals
25. Participation and concentration of workers with a high school diploma and postsecondary middle skills working in CTE for top six career clusters and completion of postsecondary sub-baccalaureate degrees by award type and career cluster
26. Through 2018, Business, Management, and Administration; Marketing, Sales, and Service; and Hospitality and Tourism will grow and remain the largest career clusters.
27. Career clusters with large job growth or fast growth increasingly require postsecondary education.
28. Business, Management, and Administration ranks first overall for number of jobs in 2018.
29. Hospitality and Tourism ranks first for workers with high school or less; Business, Management, and Administration is first for those with some college/no degree.
30. Health Science ranks first for Associate's degrees; Business, Management, and Administration is the top cluster for Bachelor's degrees; and Education and Training will have the most jobs for those with Master's degrees or better.
31. For educational demand in 2018, Agriculture, Food, and Natural Resources ranks first for workers with less than high school; Transportation, Distribution, and Logistics for workers with high school diplomas; Government and Public Administration for some college/no degree; Health Science for Associate's degree; Information Technology for Bachelor's degree; and Education and Training for Master's degree or better.
32. The increase in job openings for Manufacturing and Transportation, Distribution, and Logistics stems from the large number of workers who will need to be replaced when they retire.
33. Previous sources of demand for Finance; Government and Public Administration; and Law, Public Safety, Corrections, and Security will not be as strong because budget constraints or technological changes will reduce demand for labor.
34. Information Technology; Health Science; and Law, Public Safety, Corrections, and Security meet national criteria for high demand, high wages, and high skills.
35. The education level required for jobs in Agriculture, Food, and Natural Resources varies widely.
36. Several jobs within Agriculture, Food, and Natural Resources, including conservation scientists and foresters, and farm, ranch and other agricultural managers, earn wages above the MET at all levels of educational attainment.
37. Many jobs in Architecture and Construction require a high school diploma or middle skills.
38. Within Architecture and Construction, increased educational attainment results in higher earnings, and increases one's likelihood of earning wages above the MET.
39. Many jobs in Arts, A/V Technology, and Communications require a Bachelor's degree.
40. Attaining a high school diploma translates into wages above the MET for actors, telecommunications line installers and repairers, job printers, and printing machine operators.
41. Many jobs in Business, Management, and Administration require a Bachelor's degree.
42. Within Business, Management, and Administration, increased educational attainment almost always pays off.
43. Many jobs in Education and Training require a Bachelor's degree.
44. Within the Education and Training cluster, it is difficult to earn wages above the MET without a Bachelor's degree or better.
45. Many jobs in Finance require a Bachelor's degree.

46. In several Finance jobs, increasing educational attainment by one level can increase one's wages dramatically.
47. Many jobs in Government and Public Administration require a Bachelor's degree.
48. Even within the same Government and Public Administration job, such as transportation inspectors and postmasters and mail superintendents, those with higher levels of educational attainment consistently earn more.
49. The education level required for jobs in Health Sciences varies widely.
50. For registered nurses, dental hygienists and several other Health Sciences jobs, workers with higher levels of educational attainment consistently earn higher wages.
51. Many jobs in Hospitality and Tourism require a high school diploma or middle skills.
52. Food service managers earn the highest wages in Hospitality and Tourism at all levels of educational attainment.
53. Many jobs in Human Services require a Bachelor's degree.
54. Property, real estate, and community association managers earn the highest wages in Human Services at all levels of educational attainment.
55. Many jobs in Information Technology require middle skills or a Bachelor's degree.
56. Workers with only a high school diploma in Information Technology can easily earn wages above the MET.
57. Many jobs in Law, Public Safety, Corrections, and Security require a high school diploma or middle skills.
58. Within most Law, Public Safety, Security, and Corrections jobs, workers with higher levels of educational attainment earn higher wages.
59. Many jobs in Manufacturing require a high school diploma or middle skills.
60. Those who work as supervisors and managers in Manufacturing can earn wages above the MET at all education levels, but their earnings consistently increase along with their educational attainment.
61. The education level required for jobs in Marketing, Sales, and Service varies widely.
62. Some workers within Marketing, Sales, and Service, such as sales representatives surpass the MET even with a high school diploma or less; however, additional education significantly boosts their earnings.
63. Many jobs in STEM require a Bachelor's degree.
64. Within almost all STEM jobs, workers earn more than the MET even with a high school diploma or less; however, increased educational attainment significantly boosts workers' earning potential in this field.
65. Many jobs in Transportation, Distribution, and Logistics require a high school diploma or middle skills.
66. Aircraft pilots and flight engineers, and other jobs within Transportation, Distribution, and Logistics pay wages above the MET at all education levels, but attaining at least some postsecondary education can offer a big earnings boost.

Key Messages

This report presents data on job opportunities and skill requirements through 2018 arranged by the 16 career and technical education (CTE) career clusters in the Carl D. Perkins Act of 2006 (Perkins IV). These skill requirements reflect the length and extent of education and training required for the job. We detail changes in education requirements by cluster and show that the demand for postsecondary education will increase from 59 to 63 percent of all jobs by 2018.

We identify the best clusters for those with only a high school diploma, some college/no degree,¹ an Associate's degree, and a Bachelor's degree or better based on demand for and the earnings potential of occupations within those clusters.

We compare projected job demand, both in terms of rate and the actual number of jobs added. We also show the number of net new jobs caused by new job creation and replacement jobs caused by workers retiring, moving between career clusters, or permanently leaving the workforce. We then identify the high-demand CTE clusters from these comparisons.

Finally, we present wage data by education distribution for the CTE clusters to help identify high-wage clusters and occupations. Added to these data are comparisons of lower wage jobs with the Minimum Earnings Threshold (MET) of \$35,000.² Program planners can use this information, along with their knowledge of regional labor-market conditions and employer advice, to design and deliver CTE programs that meet workforce needs and the goals of Perkins IV.

Jobs for workers with only a high school diploma or less than high school still exist but are quickly declining.

- Thirty-seven percent of all jobs in 2018 will be for workers who have either a high school diploma or incomplete high school education with some on-the-job training. This number is down from 72 percent in 1973, 44 percent in 1992, and 41 percent in 2007.
- The overall share of employment opportunities requiring a high school diploma or less gets smaller for all career clusters by 2018, except for Architecture and Construction, where there is a very slight increase.

- Jobs for workers with a high school diploma or less are concentrated in four career clusters. Sixty percent of all new and replacement jobs in the U.S. economy between 2008 and 2018 will be in Hospitality and Tourism (27%), Transportation, Distribution, and Logistics (13%), Architecture and Construction (11%), and Manufacturing (9%).
- The best opportunities for workers with a high school diploma are in male-dominated fields. Over 80 percent of the workforce in Manufacturing; Architecture and Construction; and Transportation, Distribution, and Logistics are men.

Workers with postsecondary middle skills (some college/no degree or an Associate's degree) comprise 29 percent of all job openings by 2018.

- Jobs for workers with postsecondary middle skills are concentrated in six occupational clusters (compared to four for those with a high school diploma or less). Sixty-four percent of all new and replacement jobs in the U.S. economy between 2008 and 2018 will be in Manufacturing (8%); Marketing, Sales, and Service (9%); Transportation, Distribution, and Logistics (9%); Health Science (10%), Business, Management, and Administration (13%); and Hospitality and Tourism (16%).
- Women need postsecondary education to earn wages that men with a high school diploma earn. As we move up the education ladder into postsecondary middle-skill education, women have greater proportions of opportunity in Business Management, and Administration (59% female); Marketing, Sales, and Service (49% female); Health Science (45% female); and Hospitality and Tourism (45% female).

A Bachelor's degree or better guarantees access to all career clusters.

- Seventy-two percent of jobs available for workers with a Bachelor's degree or better are found in nine occupational clusters. Yet at this education level, all career clusters are essentially accessible. The remaining 28 percent of jobs for workers with a Bachelor's degree or better pay the highest wages relative to the career cluster.
- A Bachelor's or better offers accessibility to all high-paying jobs within occupational clusters, but it is not a guarantor. Occupation matters a great deal.

¹ Some college/no degree and an Associate's degree fall into the postsecondary education level called middle skills.

² We define a Minimum Earning Threshold (MET) as an absolute poverty-based definition of the earnings level that equals 150 percent of the federal poverty level (FPL) for a family of four. It can also be considered the wage level necessary to enter into the middle class.

The fastest growing clusters have the highest concentration of postsecondary workers.

- The clusters with the largest job growth have high shares of postsecondary employment and/or are experiencing rapid levels of postsecondary upskilling; that is, workers within a career cluster are obtaining additional postsecondary education to advance their careers and increase their wages. For example, more than 60 percent of the total job-openings for workers with some college/no degree and/or an Associate's degree are in the career clusters that rank first through sixth overall: Hospitality and Tourism; Business, Management, and Administration; Transportation, Distribution, and Logistics; Marketing, Sales and Service; Health Science; and Architecture and Construction.
- The top three career clusters (Business, Management and Administration; Marketing, Sales, and Service; and Hospitality and Tourism) are expected to grow and retain their top ranking in terms of number of jobs.
- Health Science is projected to rank first in the number of jobs added and second in growth rate through 2018.
- Registered nurses hold the largest number of jobs in healthcare. Most individuals enter the field with an Associate's degree. The same is true for a large number of allied health occupations, such as diagnostic technician and therapy assistant. These occupations have smaller employment sizes but are still expected to show rapid growth due to the increased demand for healthcare.

Although oldline Manufacturing continues to decline in employment totals, job openings will arise from baby boom retirements.

- Due largely to increases in productivity and some evidence of offshoring, employment in Manufacturing is expected to show very little net change over the decade from its 2008 level, which was already decimated by the recession. There will, however, be more than 2 million job openings from baby boom retirements.
- The number of direct jobs in Science, Technology, Engineering, and Mathematics (STEM) is relatively small. Demand for engineers is also closely tied to trends in manufacturing. Many trained engineers and scientists are expected to move into other industries and career clusters, such as Business, Management, and Administration; and Marketing, Sales, and Service.

Many of the larger clusters grow slowly and do not pay a living wage.

- There is a wide distribution of wages across career clusters. The STEM cluster pays the highest wages overall, an average of \$74,000. Conversely, wages in Hospitality and Tourism averaged \$29,000 in 2008.
- Across time, wage growth is best in Business, Management, and Administration; Finance; Health Science; Information Technology; and Law, Public Safety, Corrections, and Security. The average growth of real wages between the 1980s and the 2000s is 27 percent. Health Science and Business, Management, and Administration experienced growth of at least twice the national average (10%) or higher. Agriculture, Food, and Natural Resources; Architecture and Construction; Transportation, Distribution, and Logistics; and Manufacturing experienced wage growth of less than one-half the national average.
- STEM and Information Technology are the best paying career clusters for workers with middle skills.
- The gender wage gap varies by cluster. The extent of the difference in wages between men and women across clusters ranges from \$2,000 in Architecture and Construction to \$69,000 in Health Science.

Inclusion of certifications-preparation should be part of career-ready education.

- The education system requires substantial high school CTE programs that provide not only solid academics but also state-of-the-art training in the career cluster.
- Even where good high school CTE programs exist, employers often require not only a high school diploma, but also some form of industrial certification.

Earning Middle-Class Wages: Career Clusters and the MET

The 16 Career Clusters

Agriculture, Food and
Natural Resources
Architecture and Construction
Arts, A/V Technology, and
Communications
Business, Management, and
Administration
Education and Training
Finance
Government and Public
Administration
Health Science
Hospitality and Tourism
Human Services
Information Technology
Law, Public Safety, Corrections,
and Security
Manufacturing
Marketing, Sales, and Service
Science, Technology, Engineering,
and Mathematics (STEM)
Transportation, Distribution,
and Logistics

Educational Attainment

Less than high school
High school
Some college/no degree
Associate's degree
Bachelor's degree
Master's degree
Doctoral degree
Professional degree

In terms of opportunities for workers in the U.S. economy, from high school graduates to workers with postsecondary education and training, jobs that pay family-sustaining wages still exist but are in decline. Although most opportunities for employment and advancement are for workers with some postsecondary education and training, many jobs are still available for workers with only a high school diploma.

As mandated by the accountability requirements in the 2006 Carl D. Perkins Career and Technical Education Act (commonly known as Perkins IV), school districts, colleges, and states report their CTE performance data using the 16 career-clusters format.³ School districts, colleges, and states may use these forecasts of growth and decline by CTE career cluster to better align educational preparation with job opportunities.

The notion of more tightly aligning postsecondary institutions with the marketplace raises concerns about the commodification of education, and is a sore point for many educators. Maintaining a balance between general education and job-specific training is particularly essential for CTE.

The detailed information presented in this report regarding future employment demand by career cluster will enable CTE to pinpoint those clusters that can be the focus of developing programs of study (POS), the linchpin of Perkins IV, thus better ensuring the alignment of secondary and postsecondary segments of POS. Identifying career clusters with the highest employment demand will give secondary and postsecondary institutions and policymakers the information needed to target programs that would increase both program completion and placement of graduates, particularly in the postsecondary middle-skill workforce.⁴ Focusing on career clusters with a significant number of high-skill, high-wage, or high-demand occupations will allow CTE educators to connect their courses and programs to future workforce needs. Finally, with limited employment opportunities for those with a high school diploma or less, knowing that future employment demand for many career clusters will require at least some postsecondary education may encourage more high school graduates to exit secondary education better prepared for both college and careers.

Understanding the relationship between education and occupations is essential for understanding the forces that drive increasing demand for

education and how this demand in turn reflects the forces shaping the U.S. job market. Occupation is a simple, shorthand way of expressing all the tasks performed in a particular job and the skills and formal education needed to complete that job. Occupations generally have similar requirements regardless of the industry in which they are located. Accountants, for example, perform comparable tasks whether they are working for a mining company or a hospital; the training required to do the work is virtually the same. As a result, education requirements for occupations are relatively homogenous. The educational requirements of an industry are not really meaningful because industries are conglomerates of many different occupations and levels of educational demand.

The days when people left high school, went to work in the local industry, and then worked their way up the career ladder through a wide variety of occupations are fast disappearing. Starting out straight from high school on the loading dock or in the mailroom and climbing to the CEO's corner office is no longer an option. Individuals who work in multiple occupations within a single industry over their lifetimes are becoming rare.

This is partially a result of the increasing complexity of work today, which in turn requires specific education and training focused on a particular occupation (also known as labor market specialization). More often, education and training are focused on the occupation; career advancement reflects workers climbing up through the ranks of an occupational hierarchy. Some occupations are more tightly tied to particular industries (e.g., nurses in healthcare), but more and more occupations are dispersed broadly across industries.

Postsecondary education is of particular interest to CTE providers because it includes certificate and diploma programs and other education-delivery methods, such as apprenticeships.

Opportunities for those with a high school diploma or less still exist but are quickly declining.

Help Wanted, a 2010 report published by The Georgetown University Center on Education and the Workforce estimated that, by 2018, 63 percent of all jobs in the U.S. economy will require postsecondary education and training (Carnevale, Smith & Strohl, 2010).⁵ Further, this education and

³Perkins IV, which provides a significant portion of total CTE funds, defines CTE in this manner. However, there has been much discussion about which segment of the educational spectrum CTE actually spans. Some still define CTE in terms of traditional vocational education, which includes only parts of four of the 16 career clusters: Agriculture, Food, and Natural Resources; Architecture and Construction; Manufacturing, and Transportation, Distribution and Logistics. Those holding this narrow view of CTE seem to think of CTE as a secondary school phenomenon; the postsecondary education system is responsible for workforce development and is unrelated to traditional vocational education. The new CTE expands coverage to all 16 career clusters and has both secondary and postsecondary components through the Programs of Study (POS), the central feature of Perkins IV. The concept of POS is specifically defined in Perkins IV, and the rules for implementation have been further developed by the U.S. Department of Education (see www.cte.ed.gov). Conceptually, however, POS and career pathways, a term now being used more frequently by both CTE and workforce development, bring the two even closer. There is yet a third view, which argues that CTE covers at least all undergraduate education that awards formal degrees up to and including the Bachelor's degree. The rationale is that the ultimate goal for any student, starting in high school and proceeding from there, is to have a career, no matter which education pathway the student chooses to pursue (Grubb & Lazerson, 2005).

⁴Middle-skill jobs are defined as those requiring workers with some college/no degree, a postsecondary vocational certificate, or an Associate's degree, in other words, a variety of sub-baccalaureate education and training.

⁵Up from 59 percent in 2008, 56 percent in 1992, and 28 percent in 1973.

Earning Middle-Class Wages: Career Clusters and the MET

⁶ National Center for Education Statistics (NCES), 2010.

⁷ NCES calculated this rate as the number of first-time college freshmen enrolling in college directly from high school anywhere in the U.S. in the Fall of 2008. (Digest of Education Statistics, Washington, DC: National Center for Education Statistics, 2009, tables 105 and 203).

training is increasingly becoming the only pathway to middle-class earnings and status and is seen as providing additional economic security, as well as professional and wage advancement, in both good times and bad.

Yet the flip side of this coin is that 37 percent of all jobs in 2018 will be for workers with only a high school diploma or high school dropouts with on-the-job training. Although the analysis of occupations reveals that workers with a high school diploma or less are generally limited to career clusters that pay lower wages and are in decline, there are still potential pockets of opportunity. This is especially true in career clusters with clearly defined career lattices and ladders (e.g., nurses) that help workers envision next steps and learn about the job options available as they progress in their careers.

Seventy-four percent of high school students who became freshmen in the fall of 2004 graduated from high school on time in 2008.⁶ This number varies widely by state from 51.5 percent in Nevada to 89.6 percent in Wisconsin and by race from 61.5 percent for African Americans to 81 percent for Whites. Of this graduating high school class, only 63.3 percent went directly to college; again, this varies by state from 45.55 in Alaska to 77.4% in Mississippi.⁷ Once in college, different racial/ethnic groups also return for their second year at very different rates. For example, the retention rate for African American college students is 43 percent, 20 percentage points below the national average.

These statistics show that just over one million students who graduated on time in 2008 did not immediately go off to college. Moreover, the likelihood of students going to college and graduating from college on time decreases exponentially for nontraditional students (usually defined as anyone more than 18 to 24 years old, married, a minority, or a parent). It is these students, the 35 percent of Americans who do not attend college immediately after high school or do not attend at all, who are at greatest risk of not obtaining a job that pays a living wage or attaining middle-class status.

High school graduates are less likely than postsecondary degree holders to be members of the middle class. In 1970, 60 percent of high school graduates were in the middle class; by 2007, the share had fallen to 45 percent. Although high school graduates still have many opportunities to earn a living wage, particularly in Manufacturing and Architecture and Construction, their opportunities are largely limited to just four career clusters.

Jobs for high school graduates and dropouts are concentrated in four career clusters.

Sixty percent of all new and replacement jobs for high school workers that will open up in the U.S. economy between 2008 and 2018 will be in Hospitality and Tourism (27%), Transportation, Distribution, and Logistics (13%), Architecture and Construction (11%), and Manufacturing (9%). The concentration of jobs requiring a high school diploma or less in these four career clusters poses other concerns. The wage thresholds for many of these occupations are low. That is, they do not pay sufficient wages to sustain a family of four.

Furthermore, these career clusters are noticeably more susceptible than others to the boom and bust of the business cycle. They shed large numbers of jobs during recessions and experience large growth during prosperous times. Workers are therefore very vulnerable to the vagaries of the business cycle and recessions in particular. Poor wages, which translate to low savings, exacerbate the effects of recession on workers in these career clusters.

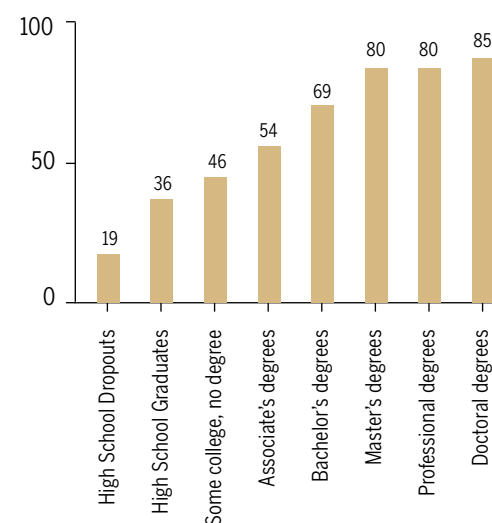
However, high school graduates still have some opportunities to earn a living wage (figure 1). This is most likely for workers in Manufacturing and Architecture and Construction or those lucky enough to obtain on-the-job training. Many hands-on jobs are also less susceptible to outsourcing. On the other hand, such occupations now require more math, science, or technical knowledge, including industry skill certifications.

The best opportunities for high school dropouts or high school graduates are in male-dominated fields.

Three of the four career clusters with the largest number of jobs for high school dropouts and high school graduates have growth rates below the national average of 10 percent between 2008 and 2018; these growth rates rank in the bottom half of all the career clusters (table 1). Manufacturing registers overall losses with a 1 percent decline in net new jobs created between 2008 and 2018.

More than 70 percent of high school workers in Manufacturing; Architecture and Construction; and Transportation, Distribution, and Logistics are men. Most workers in Hospitality and Tourism are women. This career cluster pays the lowest wages of all career clusters for workers with a high school diploma or less.

Figure 1.
Percent earning more than \$35k (2010\$)



Earning Middle-Class Wages: Career Clusters and the MET

Although some high school jobs exceed the Minimum Earnings Threshold (MET), these jobs are declining.

Whether or not a certain wage level is sufficient to guarantee access to the middle class depends on where the job is located and the state's cost of living. For this report, however, a national MET of \$35,000 will be used as a reference point for the earnings potential of career clusters. It indicates the earnings level at the lowest end of middle class status and is just about 150% of the federal poverty level (FPL) for a family of four.

As expected, wages are higher for workers with a high school diploma than for workers with less than high school (tables 2-5). The wage premium for workers with a high school diploma compared to those without one averages \$10,000 per year. The wage difference is larger or smaller depending on the industry, occupation, and the extent of training required.

The highest paying jobs for workers with a high school diploma are in Manufacturing and easily exceed the MET. Workers in these jobs are often supervisors and managers within a technical field and suggest the workers have gained a certain amount of experience and training to secure the position.

Table 1. The best opportunities to earn a living wage with less than high school or high school diplomas are concentrated in career clusters where men dominate.

CAREER CLUSTER	NEW AND REPLACEMENT JOB VACANCIES 2008-2018 (THOUSANDS)			Males per cluster (%)	Rate of growth (% change in employment)	Fastest rate of growth (rank)
	Less than high school	High school diploma	High school diploma or less (%)			
Manufacturing	420	1,250	9	71	-1	16
Architecture and Construction	760	1,200	11	98	7	11
Transportation, Distribution, and Logistics	560	1,800	13	85	4	14
Hospitality and Tourism	1,670	3,190	27	50	12	6
All other clusters	1,230	5,670	40			

SOURCE: The Georgetown University Center on Education and the Workforce forecast of educational demand through 2018.

Table 2. The best paying opportunities for women in middle skill jobs pay less than the best paying opportunities for men with less than high school or a high school diploma.

	YEARLY WAGE, 2007-2009 (\$)	
	Less than high school	High school diploma
Inspectors, testers, sorters, samplers, and weighers	25,500	35,300
Welders, cutters, solderers, and brazers	31,500	36,900
Computer, automated teller, and office machine repairers	31,500	38,800
Production, planning, and expediting clerks	33,600	39,400
Maintenance and repair workers, general	32,800	40,300
Machinists	34,700	42,600
Industrial machinery mechanics	36,500	45,500
First-line supervisors/managers of production and operating workers	37,900	47,600
Telecommunications equipment installers and repairers, except line installers	39,300	50,300
First-line supervisors/managers of mechanics, installers, and repairers	44,400	53,700

SOURCE: The Georgetown University Center on Education and the Workforce

Earning Middle-Class Wages: Career Clusters and the MET

Table 3. Workers with high school diplomas in Architecture and Construction can earn wages above the MET.

	YEARLY WAGE, 2007-2009 (\$)	
	Less than high school	High school diploma
Highway maintenance workers	30,000	36,000
Heating, air conditioning, and refrigeration mechanics and installers	32,100	38,200
Sheet metal workers	29,600	40,000
Plumbers, pipefitters, and steamfitters	30,400	41,000
Operating engineers and other construction equipment operators	35,400	41,700
Electricians	33,000	42,500
First-line supervisors/managers of construction trades and extraction workers	40,500	48,400
Construction managers	38,300	49,500
Cost estimators	63,200	56,800

SOURCE: The Georgetown University Center on Education and the Workforce

Table 4. Workers with high school diplomas working in Transportation, Distribution, and Logistics can earn wages above the MET.

	YEARLY WAGE, 2007-2009 (\$)	
	Less than high school	High school diploma
Automotive service technicians and mechanics	25,700	35,200
Automotive body and related repairers	30,600	37,000
Bus and truck mechanics and diesel engine specialists	35,400	41,300
First-line supervisors/managers of helpers, laborers, and material movers, hand	39,300	44,400
Mobile heavy equipment mechanics, except engines	36,000	46,200
Aircraft mechanics and service technicians	42,300	50,800

SOURCE: The Georgetown University Center on Education and the Workforce

Table 5. Workers with high school diplomas working as food service managers in Hospitality and Tourism earn wages just below the MET.

	YEARLY WAGE, 2007-2009 (\$)	
	Less than high school	High school diploma
First-line supervisors/managers of food preparation and serving workers	22,900	25,500
First-line supervisors/managers of housekeeping and janitorial workers	23,900	30,000
Food service managers	30,200	33,900

SOURCE: The Georgetown University Center on Education and the Workforce

Women need postsecondary education to earn wages that men with a high school diploma earn.

Three of the six career clusters with the largest number of middle-skill jobs for workers with some college/no degree or an Associate's degree have growth rates above the national average of 10 percent between 2008 and 2018; these growth rates rank in the top half of all the career clusters. Health Science, the second-fastest growing career cluster, will have more job openings than Manufacturing. Hospitality and Tourism will have as many job openings through 2018 as both Manufacturing and Health Science combined.

Moving up the education ladder into postsecondary education at the middle-skill level (some college/no degree, a postsecondary vocational certificate, or an Associate's degree), women have greater opportunities in Business, Management, and Administration (59% female); Marketing, Sales, and Service (49% female); Health Science (45% female); and Hospitality and Tourism (45% female).

Some middle-skills jobs exceed the MET.

Using the same standardized definition of high-wage jobs at \$35,000, workers with some college/no degree or an Associate's degree have more opportunities to attain middle class status (tables 6-11). The highest paying jobs for workers with some college/no degree or an Associate's degree are in Business, Management, and Administration; and Manufacturing.

BEST MIDDLE-SKILL JOBS

Table 6. Middle-skill workers in Marketing, Sales, and Service can earn wages above the MET.

	YEARLY WAGE, 2007-2009 (\$)	
	Some college/ no degree ^a	Associate's degree
Real estate brokers	37,900	36,500
Wholesale and retail buyers, except farm products	40,000	43,100
Sales and related workers, all other	42,400	44,500
Market research analysts	54,100	55,100
First-line supervisors/managers of nonretail sales workers	56,600	56,000
Sales representatives, services, all other	56,500	58,300
Sales representatives, wholesale and manufacturing, technical and scientific products	57,700	59,900

SOURCE: The Georgetown University Center on Education and the Workforce

^a Some college includes postsecondary vocational certificates.

Table 7. Middle-skill workers in Manufacturing can earn wages above the MET.

	YEARLY WAGE, 2007-2009 (\$)	
	Some college/ no degree ^a	Associate's degree
Team assemblers	35,500	—
Welders, cutters, solderers, and brazers	39,900	—
Production workers, all other	38,000	—
Computer, automated teller, and office machine repairers	41,900	43,200
Production, planning, and expediting clerks	41,800	43,900
Inspectors, testers, sorters, samplers, and weighers	42,000	44,600
Maintenance and repair workers, general	44,300	46,500
Machinists	45,300	47,700
Industrial machinery mechanics	50,500	51,000
Telecommunications equipment installers and repairers, except line installers	53,500	54,800
First-line supervisors/managers of production and operating workers	53,800	—
First-line supervisors/managers of mechanics, installers, and repairers	58,200	61,000

SOURCE: The Georgetown University Center on Education and the Workforce

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

Earning Middle-Class Wages: Career Clusters and the MET

Table 8. Middle-skill workers in Transportation, Distribution, and Logistics can earn wages above the MET.

	YEARLY WAGE, 2007-2009 (\$)	
	Some college/ no degree ^a	Associate's degree
Automotive body and related repairers	37,800	41,100
Automotive service technicians and mechanics	38,000	42,300
Bus and truck mechanics and diesel engine specialists	43,000	44,700
First-line supervisors/managers of helpers, laborers, and material movers, hand	47,600	45,800
Mobile heavy equipment mechanics, except engines	48,400	48,700
Aircraft mechanics and service technicians	53,800	55,400

SOURCE: The Georgetown University Center on Education and the Workforce

^a Some college includes postsecondary vocational certificates.

Table 9. Middle-skill workers in Health Science can earn wages above the MET.

	YEARLY WAGE, 2007-2009 (\$)	
	Some college/ no degree ^a	Associate's degree
Licensed practical and licensed vocational nurses	36,500	36,100
Occupational therapists	—	37,100
Medical and clinical laboratory technologists	35,500	39,700
Physical therapists	—	41,800
Dental hygienists	38,600	43,800
Respiratory therapists	46,300	48,200
Radiologic technologists and technicians	47,200	50,500
Licensed practical and licensed vocational nurses	36,500	36,100
Occupational therapists	—	37,100

SOURCE: The Georgetown University Center on Education and the Workforce

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

Table 10. Middle-skill workers in Business, Management, and Administration can earn wages above the MET.

	YEARLY WAGE, 2007-2009 (\$)	
	Some college/ no degree ^a	Associate's degree
Office and administrative support workers, all other	35,800	36,100
Accountants and auditors	42,200	40,500
First-line supervisors/managers of office and administrative support workers	43,200	44,500
Business operation specialists, all other	44,200	48,000
Management analysts	56,800	56,000
Industrial production managers	58,300	56,800
Medical and health services managers	51,500	59,400
Managers, all other	60,500	60,100
Sales managers	70,800	67,400
General and operations managers	68,700	71,000

SOURCE: The Georgetown University Center on Education and the Workforce

^a Some college includes postsecondary vocational certificates.

Table 11. Middle-skill workers in Hospitality and Tourism can earn wages close to or above the MET.^a

	YEARLY WAGE, 2007-2009 (\$)	
	Some college/ no degree ^a	Associate's degree
First-line supervisors/managers of housekeeping and janitorial workers	35,600	34,100
Food service managers	38,400	41,300

SOURCE: The Georgetown University Center on Education and the Workforce

^a Some college includes postsecondary vocational certificates.

Earning Middle-Class Wages: Career Clusters and the MET

Postsecondary education increases opportunity and access.

Our grandparents' economy, which promised good-paying jobs for anyone who graduated from high school, is fading and will soon be gone. Over the past three decades, higher education has become a virtual must for American workers. The five fastest-growing career clusters require between 70 and 94 percent of workers to have postsecondary education and training.

Jobs for workers with some college/no degree or an Associate's degree are concentrated in six career clusters (compared to four for workers with a high school diploma or less).

Sixty-four percent of all new and replacement jobs for middle skill workers that will open up in the U.S. economy between 2008 and 2018 will be in Manufacturing (8%), Marketing, Sales, and Service (9%), Transportation, Distribution, and Logistics (9%), Health Science (10%), Business, Management, and Administration (13%), and Hospitality and Tourism (16%) (table 12).

Table 12. The best opportunities to earn a living wage with middle skills are concentrated in six career clusters.

NEW AND REPLACEMENT JOB VACANCIES 2008-2018 (THOUSANDS)						
CAREER CLUSTER	Some college/ no degree ^a	Associate's degree	Some college/no degree/Associate's degree (%)	Males per cluster (%)	Rate of growth (% change in employment)	Fastest rate of growth (rank)
Manufacturing	600	400	8	79	-1	16
Marketing, Sales, and Service	800	400	9	49	11	7
Transportation, Distribution, and Logistics	900	400	9	81	4	14
Health Science	500	800	10	13	21	2
Business, Management, and Administration	1,100	700	13	31	6	12
Hospitality and Tourism	1,500	800	16	54	12	6
All others	2,900	2,100	36			

SOURCE: The Georgetown University Center on Education and the Workforce forecast of educational demand through 2018.

^a Some college includes postsecondary vocational certificates.

Workers who add some college/no degree or an Associate's degree to their education receive three immediate benefits

1. Increased average earnings from \$24,000 to \$37,000 per year;
2. Greater flexibility in choosing jobs within and among six, rather than just four, career clusters;
3. An increasing share of job opportunities from 10 percent of all jobs for workers with less than high school or a high school diploma to 27 percent of all jobs for workers with some college/no degree or an Associate's degree.

A Bachelor's degree or better guarantees access to all career clusters.

Seventy-two percent of jobs available for workers with a Bachelor's degree or better are found in nine career clusters (table 13). Further, at this education level all the career clusters are accessible.

Table 13. Seventy-two percent of all jobs for college degree holders will be in nine career clusters.

NEW AND REPLACEMENT JOB VACANCIES 2008-2018 (THOUSANDS)						
CAREER CLUSTER	Bachelor's degree	Master's degree or better	Bachelor's degree or better (%)	Males per cluster (%)	Rate of growth (% change in employment)	Fastest rate of growth (rank)
Science, Technology, Engineering, and Mathematics (STEM)	336	271	4	80	9	9
Finance	540	123	4	65	10	8
Government and Public Administration	159	43	1	59	8	10
Information Technology	725	325	7	72	23	1
Marketing, Sales, and Service	1,013	175	7	62	11	7
Hospitality and Tourism	1,120	193	8	61	12	6
Health Science	953	798	11	37	21	2
Business, Management, and Administration	1,722	571	14	55	6	12
Education and Training	1,204	1,196	15	30	14	5
All others	3,332	1,094	28			

SOURCE: The Georgetown University Center on Education and the Workforce forecast of educational demand through 2018.

To determine the career clusters that fall into the Bachelor's or better category, both information on the size of the clusters and the amount of education required for workers are combined. Size drives the inclusion of big career clusters such as Business, Management, and Administration; Education and Training; Marketing, Sales, and Service; and Hospitality and Tourism. The proportion of workers with a Bachelor's degree or better drives the inclusion of STEM; Finance; and Government and Public Administration. Thus, although STEM; Finance; and Government and Public Administration are relatively small, (only 9 percent of jobs in these career clusters require a Bachelor's degree or better), between one-third to more than one-half of workers require a Bachelor's degree or better (STEM, 50%; Finance, 55%; and Government and Public Administration, 35%).

Six of the nine career clusters have growth rates at or above the national average. Health Science and Information Technology, however, are projected to grow in the double digits, more than two times faster than the national average.

A Bachelor's degree or better offers accessibility to all high-paying jobs within career clusters, but it is not a guarantor. Occupation matters.

Although education matters enormously in determining earnings, an individual's earnings are not dependent solely on educational attainment. Occupation (the job someone does) matters, too. Of course, occupation and educational attainment are tightly linked: Some occupations require more education than others. In almost all cases, workers with a Bachelor's degree will earn higher wages than workers without one: additional education increases productivity, and employers are willing to reward this productivity with a wage premium.

In two of nine career clusters, the proportion of women exceeds that of men: Education and Training; and Health Science. The wage distribution in these career clusters, however, is wide and highly dependent on career choice. For example, an elementary school teacher can increase his or her salary by 33 percent by obtaining a Master's degree or better. Although the salary for this particular degree surpasses the MET, it is far lower than the average wage of similarly educated workers in other career clusters.

The best-paying jobs by education level are still held by doctors and nurses in Health Science, whereas managers and CEOs in Business, Management, and Administration and professional jobs rank second for the size of their wage premiums. STEM jobs also pay well at every education level, a trend that remains consistent across time.

However, earnings vary widely by occupation. Someone with a Bachelor's degree working in a STEM occupation makes more than someone with a Master's degree working in Education and Training. Someone with a Master's degree or better in Health Science; Business, Management, and Administration; and STEM occupations receives a vastly superior wage premium compared to a worker with similar education in Hospitality and Tourism. Ultimately, occupation-specific human capital ties people to their occupations and can result in substantial wage premiums for specialized tasks. Occupational choice is highly correlated to earnings, regardless of educational attainment.

Most jobs for workers with a Bachelor's degree or better pay wages exceeding the MET.

Very few occupations for workers with a Bachelor's degree do not meet or surpass the MET (tables 14-22). Although postsecondary education and training is highly correlated with middle-class wages, a Bachelor's degree largely guarantees it.

Occupations that fail to meet the high-wage criterion for workers with a Bachelor's degree or better are not truly Bachelor's degree jobs; greater proportions of workers in these jobs have lower educational attainment. A Bachelor's degree will not pay a high wage increase in this instance and indicates a worker will have no further upward mobility within that occupation. An individual looking to increase his or her earnings potential in these special cases, should branch out to another occupation.

BEST COLLEGE-LEVEL JOBS (BACHELOR'S DEGREE OR BETTER)

Table 14. College-level workers in Business, Management, and Administration can earn wages well above the MET in managerial positions.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Chief executives	154,700	179,100
General and operations managers	96,100	125,400
Sales managers	97,300	120,100
Industrial production managers	93,200	143,500
Medical and health services managers	72,000	97,100
Managers, all other	88,500	115,000
Management analysts	77,300	97,000
Business operation specialists, all other	57,900	77,300
Accountants and auditors	66,300	86,900
First-line supervisors/managers of office and administrative support workers	57,100	—
Bookkeeping, accounting, and auditing clerks	32,800	—
Receptionists and information clerks	25,900	—
Executive secretaries and administrative assistants	33,500	—
Data entry keyers	30,100	—
Office and administrative support workers, all other	43,600	—

SOURCE: The Georgetown University Center on Education and the Workforce
— Cell data suppressed due to small sample size.

Table 15. College-level workers in Education and Training can earn wages above the MET in a number of occupations.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Education administrators, elementary and secondary school	50,300	74,500
Clinical, counseling, and school psychologists	—	48,300
Postsecondary teachers	30,200	55,900
Preschool teachers, except special education	25,800	37,100
Elementary school teachers, except special education	38,500	51,500
Secondary school teachers, except special and vocational education	41,600	53,600
Special education teachers, preschool, kindergarten, and elementary school	38,900	51,500
Librarians	32,300	49,100
Library technicians	22,500	37,900
Teacher assistants	18,300	—
Education, training, and library workers, all other	39,600	54,400
Coaches and scouts	46,800	56,000

SOURCE: The Georgetown University Center on Education and the Workforce

— Cell data suppressed due to small sample size.

Table 16. College-level workers in Finance commonly can earn wages well above the MET.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Claims adjusters, examiners, and investigators	55,100	—
Credit analysts	55,600	101,100
Financial analysts	100,100	177,100
Personal financial advisors	100,800	132,000
Insurance underwriters	70,700	—
Loan officers	70,500	—
Tax preparers	47,700	94,600
Financial specialists, all other	88,600	138,200
Actuaries	121,500	122,900
Insurance sales agents	77,000	—
Securities, commodities, and financial services sales agents	125,800	196,300
Bill and account collectors	35,100	—
Tellers	24,600	—
Brokerage clerks	66,100	—
Credit authorizers, checkers, and clerks	54,700	—
Loan interviewers and clerks	44,500	—
Insurance claims and policy processing clerks	42,500	—

SOURCE: The Georgetown University Center on Education and the Workforce
 — Cell data suppressed due to small sample size.

Table 17. College-level workers in most Government and Public Administration occupations can commonly earn wages well above the MET.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Postmasters and mail superintendents	84,700	122,400
Compliance officers, except agriculture, construction, health and safety, and transportation	70,100	89,000
Appraisers and assessors of real estate	51,200	—
Financial examiners	76,400	92,800
Tax examiners, collectors, and revenue agents	56,800	—
Economists	80,900	119,800
Urban and regional planners	60,300	66,300
Detectives and criminal investigators	75,500	82,500
Court, municipal, and license clerks	41,300	—
Eligibility interviewers, government programs	43,700	—
Interviewers, except eligibility and loan	32,600	—
Postal service clerks	50,600	—
Postal service mail carriers	49,300	—
Postal service mail sorters, processors, and processing machine operators	51,500	—
Statistical assistants	49,300	—
Transportation inspectors	57,400	—

SOURCE: The Georgetown University Center on Education and the Workforce
— Cell data suppressed due to small sample size.

Table 18. College-level workers in Health Science earn wages above the MET in a number of growing occupations.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Pharmacists	90,700	96,600
Physicians and surgeons	—	165,200
Registered nurses	57,300	70,100
Occupational therapists	50,800	50,700
Physical therapists	58,800	—
Respiratory therapists	53,300	56,000
Speech-language pathologists	—	48,400
Medical and clinical laboratory technologists	48,300	—
Dental hygienists	47,000	—
Radiologic technologists and technicians	54,100	—
Pharmacy technicians	32,500	—
Medical records and health information technicians	35,500	—

SOURCE: The Georgetown University Center on Education and the Workforce
 — Cell data suppressed due to small sample size.

Table 19. College-level workers in Hospitality and Tourism can earn wages above the MET as food service managers.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Food service managers	51,600	54,600
Self-enrichment education teachers	29,600	34,700
First-line supervisors/managers of food preparation and serving workers	39,100	—
Bartenders	25,500	—
Waiters and waitresses	22,100	—
Hosts and hostesses, restaurant, lounge, and coffee shop	18,200	—
Amusement and recreation attendants	28,700	—
Hotel, motel, and resort desk clerks	23,100	—

SOURCE: The Georgetown University Center on Education and the Workforce

— Cell data suppressed due to small sample size.

Table 20. College-level workers in many Information Technology jobs earn wages well above the MET.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Food service managers	51,600	54,600
Self-enrichment education teachers	29,600	34,700
First-line supervisors/managers of food preparation and serving workers	39,100	—
Bartenders	25,500	—
Waiters and waitresses	22,100	—
Hosts and hostesses, restaurant, lounge, and coffee shop	18,200	—
Amusement and recreation attendants	28,700	—
Hotel, motel, and resort desk clerks	23,100	—

SOURCE: The Georgetown University Center on Education and the Workforce

— Cell data suppressed due to small sample size.

Table 21. College-level workers in Marketing, Sales, and Service can earn the most as supervisors, sales representatives, and market research analysts.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Wholesale and retail buyers, except farm products	57,300	68,500
Market research analysts	71,400	97,700
First-line supervisors/managers of nonretail sales workers	90,100	—
Counter and rental clerks	39,900	—
Retail salespersons	49,100	—
Sales representatives, services, all other	89,000	—
Sales representatives, wholesale and manufacturing, technical and scientific products	87,200	—
Demonstrators and product promoters	36,500	—
Real estate brokers	58,300	—
Telemarketers	36,200	—
Door-to-door sales workers, news and street vendors, and related workers	18,800	—
Sales and related workers, all other	65,300	75,200
Customer service representatives	44,000	—
Order clerks	35,500	—
Office clerks, general	32,800	—

SOURCE: The Georgetown University Center on Education and the Workforce
— Cell data suppressed due to small sample size.

Table 22. College-level workers in STEM can earn wages above the MET, especially as engineering managers.

	YEARLY WAGE, 2007-2009 (2009\$)	
	Bachelor's degree	Master's degree or better
Engineering managers	117,100	134,600
Computer and information scientists, research	74,700	88,700
Aerospace engineers	86,900	99,600
Computer hardware engineers	82,900	96,100
Electrical engineers	85,400	102,500
Industrial engineers	74,400	81,800
Mechanical engineers	77,100	87,500
Engineers, all other	82,900	96,400
Architectural and civil drafters	46,100	—
Electrical and electronic engineering technicians	52,900	—
Chemists	60,700	85,600
Environmental scientists and specialists, including health	64,400	83,500
Biological technicians	49,400	70,400
Chemical technicians	51,000	—
Life, physical, and social science technicians, all other	42,100	46,700
Technical writers	60,000	64,900

SOURCE: The Georgetown University Center on Education and the Workforce
 — Cell data suppressed due to small sample size.

Forecasting Employment Demand by Career Cluster

In an ideal world, employers would like employees to have a strong foundation in academic and technical preparation in high school and graduate from high school prepared for work. The inability of high schools to produce postsecondary-ready graduates is well documented. This weakness at preparing students who are not immediately college bound for the workforce while they are in high school is magnified at the postsecondary level because there is already a mismatch between the supply of graduates and employment demand.

Help Wanted

Two overarching conclusions of *Help Wanted* are pertinent. First, the most recent recession and the slow economic recovery are accelerating the shift toward more postsecondary qualifications for workers. The jobs replacing the ones lost in the recession will be very different kinds of jobs, requiring very different kinds of workers and very different kinds of preparation. Second, the current postsecondary system will not meet the growing demand for workers with postsecondary education and training.

Carnevale et al. 2001, argue that the ability to help people match their educational preparation to the jobs and careers they seek is not adequate in the United States.⁸ At its core, the shift from vocational education to CTE reflects fundamental economic and technological changes. These changes have been driven by the relentless automation of physical and mental tasks in occupations, resulting in the growth of nonrepetitive tasks in an increasing number of occupations.

Deeper technical skills are required to handle the growing share of nonrepetitive tasks, and broader skills are required to move from one customized task to another. In addition, the automation of repetitive tasks leaves workers with overlapping assignments and increased interaction with each other. This increases the demand for such soft skills as general interpersonal skills and teamwork. In broad form these effects, referred

to by economists as skill-biased technological change, are reinforced by a related change in the mix of industries and occupations from an industrial economy to a postindustrial service economy. Finally, the pace of technological and economic change has accelerated: Workers need to be better prepared to adapt to changes in the labor market.

The CTE community has responded to these new realities by broadening, deepening, and aligning occupational curricula between high schools and postsecondary institutions. These changes have led to a gradual shift from more narrow and truncated vocational curricula to career clusters, career pathways, and programs of instruction that link secondary, postsecondary, and employer-based learning.

Using the same methodology as the Carnevale et al. 2010 report, occupational data in the 16 career clusters are an aggregation of the CTE programming currently offered at secondary and postsecondary institutions throughout the United States. Further divided into 79 career pathways, the career clusters represents a more focused area of concentration within each career cluster.⁹

Employment projections by career cluster, educational attainment, and current and future employment demand are necessary for several reasons. The primary reason is to help states and local recipients of Perkins IV funds develop programs of study (POS). As part of POS development, states and local recipients must use labor market information to determine which POS provide the best career opportunities for participants. Availability of data on future employment demand should enable the field of CTE to pinpoint career clusters that can be the focus for developing POS, thus better ensuring the alignment of the secondary and postsecondary elements of POS.

Knowing which career clusters are in demand by education requirements for employment provides information about which levels of educational attainment, particularly in critical areas of science and math, are in most need. This information is also necessary for making sure high school students are college- and career-ready. Postsecondary education has become the new normal.

⁸ Although more of such information is made available, it is simply not being used.

⁹ The National Association of State Directors of Career Technical Education Consortium (NASDCTEC) is responsible for maintaining the crosswalks between education programming (CIP codes), the 16 career clusters, the 79 pathways, and occupations Standard Occupational Codes (SOCs). See www.careerclusters.org for more details.

● Forecasting Employment Demand by Career Cluster

¹⁰ NCES does not have a consistent method for classifying CTE clusters. The choice of the number of clusters depends on how a specific sample survey chooses to classify occupational areas. Depending on how courses and programs are assigned to clusters — the Classification of Secondary School Courses (CSCS) for secondary and Classification of Instructional Programs (CIP) for postsecondary — the number of clusters can be anywhere from 10 to 13. The NCES provides postsecondary CTE enrollment and completions only at the postsecondary middle-skill level.

Finally, given the recent emphasis on improving college completion, specifically at the postsecondary middle-skills level, identifying those career clusters where employment demand is highest may provide the information needed to target programs that would increase both completion rates and placement of graduates.

Current supply of secondary and postsecondary CTE graduates by career cluster

CTE spans at least six years of a student's education, starting in ninth grade and ending with an Associate's degree from a community college. Many career clusters (Business, Management, and Administration; Information Technology; and STEM) are increasingly requiring a Bachelor's degree for entry into employment. Tables 23 and 24 show the distributions by career cluster for workers with a high school diploma, some college/no degree, and an Associate's degree.¹⁰

Table 23. Participation and concentration of workers with high school diplomas and postsecondary middle skills in CTE, completion by diploma or degree and career cluster

HIGH SCHOOL DIPLOMAS			POSTSECONDARY MIDDLE SKILLS					
Diplomas conferred and major secondary field of study	Participants (thousands)	Concentrators (thousands)	Degrees conferred and major postsecondary field of study	Total, all award levels (thousands)	Associate's degree (thousands)	CERTIFICATE		
						Less than 1 year	At least 1 but less than 2 academic years	At least 2 but less than 4 years
Agriculture and natural resources	278,557	179,821	Agriculture and natural resources	11,336	5,838	3,630	1,541	327
Business	962,315	187,708	Business	114,236	83,761	19,324	10,720	431
Marketing	228,329	85,246	management					
Consumer and culinary services	483,388	134,090	Business support	28,525	8,867	11,960	7,559	139
Communications and design	728,942	125,045	Marketing	17,151	7,374	8,642	1,101	34
Health sciences	225,249	130,180	Consumer services	126,891	25,482	37,437	57,317	6,655
Computer and information sciences	470,045	87,299	Communication and design	28,200	18,823	4,123	4,615	639
Engineering technologies	285,746	62,822	Health sciences	461,018	145,436	170,823	133,791	10,968
Manufacturing, repair, and transportation	534,621	276,471	Computer and information sciences	46,154	27,712	11,569	6,125	748
Construction and architecture	162,296	74,511	Engineering, architecture, and science technologies	53,705	34,022	9,990	8,830	863
Public services	166,678	35,181	Manufacturing, construction, repair, and transportation	157,259	23,970	68,155	56,470	8,664
			Education	19,427	13,021	4,008	2,344	54
			Protective services	57,452	28,208	23,331	5,787	126
			Public, legal, and social services	23,435	15,421	3,267	3,853	894

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2006-07 Completions and 2007-08 Institutional Characteristics (IC) data files; U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, High School Transcript Study (HSTS), 2005.

Forecasting Employment Demand by Career Cluster

Table 24. Participation and concentration of workers with high school diplomas and postsecondary middle skills in CTE, ranking of diploma or degree totals

HIGH SCHOOL DIPLOMAS			POSTSECONDARY MIDDLE SKILLS					
Diplomas conferred and major secondary field of study	Participants	Concentrators	Degrees conferred and major postsecondary field of study	Total, all award levels	Associate's degree	CERTIFICATE		
						Less than 1 year	At least 1 but less than 2 academic years	At least 2 but less than 4 years
Agriculture and natural resources	7	3	Agriculture and natural resources	13	13	12	12	9
Business	1	2	Business	4	2	5	4	8
Marketing	8	8	management					
Consumer and culinary services	4	4	Business support	8	11	6	6	10
Communications and design	2	6	Marketing	12	12	9	13	13
Health sciences	9	5	Consumer services	3	6	3	2	3
Computer and information sciences	5	7	Communication and design	9	8	10	9	7
Engineering technologies	6	10	Health sciences	1	1	1	1	1
Manufacturing, repair, and transportation	3	1	Computer and information sciences	7	5	7	7	6
Construction and architecture	11	9	Engineering, architecture, and science technologies	6	3	8	5	5
Public services	10	11	Manufacturing, construction, repair, and transportation	2	7	2	3	2
			Education	11	10	11	11	12
			Protective services	5	4	4	8	11
			Public, legal, and social services	10	9	13	10	4

Ranking derived from table 23.

Table 24 ranks the information in table 23 by individual award totals. The tables show how CTE preparation varies by career cluster, by the level of course-taking in high school, and the length of the terminal degree at the postsecondary middle-skill level. For high school the ranking by CTE participation is somewhat different from ranking by CTE concentration.¹¹

The top six career clusters by participant enrollment are: business, communications and design, manufacturing, repair, and transportation, consumer and culinary services, computer and information sciences, and engineering technologies. The top six career-cluster concentrators specialize in are: manufacturing, repair, and transportation, business, agriculture and resources, consumer and culinary services, health sciences, and communications and design.

The mix changes slightly for postsecondary education. The top six career clusters, regardless of postsecondary middle-skill award, are: health sciences, manufacturing, construction, repair, and transportation, consumer services, business management, protective services, and engineering, architecture, and science technologies.

For an Associate's degree, five of the top six occupational areas are the same. Computer and information sciences replaces manufacturing; and construction, repair, and transportation in rank. The top six career clusters appear to vary a little across the types of certificates compared to Associate's degrees. Three other career clusters appear on the certificate list: (1) business support, (2) manufacturing, construction, repair, and transportation, and (3) public, legal, and social services.

Table 25 lists the top six career clusters for participants and concentrators, the four postsecondary award types, and all postsecondary middle-skill awards. The table reveals several interesting facts about how CTE operates at the secondary and postsecondary levels. Several career clusters are the same for both participants and concentrators; this indicates preparation levels are more intensive in high school. Participating in business and computer and information sciences implies that high school graduates are enrolling in and completing courses that teach basic skills required for today's economy.

¹¹ CTE participation in the high school is defined as a student enrolling in at least one credit in any CTE course. CTE concentration is defined as a student taking at least three credits in at least one occupational area as defined by NCES. In 2005, 96% of all high school graduates took at least one CTE course; 54% were defined as taking at least three credits in any career cluster.

Forecasting Employment Demand by Career Cluster

Table 25. Participation and concentration of workers with high school diplomas and postsecondary middle skills working in CTE for top six career clusters by award type and career cluster

HIGH SCHOOL DIPLOMAS			POSTSECONDARY MIDDLE SKILLS			
Participants	Concentrators	Less than 1 year	At least 1 but less than 2 academic years	Associate's degree	At least 2 but less than 4 years	Total, all award levels
Business	Manufacturing, repair, and transportation	Health sciences	Health sciences	Health sciences	Health sciences	Health sciences
Communications and design	Business	Manufacturing, construction, repair, and transportation	Consumer services	Business management	Manufacturing, construction, repair, and transportation	Manufacturing, construction, repair, and transportation
Manufacturing, repair, and transportation	Agriculture and natural resources	Consumer services	Manufacturing, construction, repair, and transportation	Engineering, architecture and science technologies	Consumer services	Consumer services
Consumer and culinary services	Consumer and culinary services	Protective services	Business management	Protective services	Public, legal, and social services	Business management
Computer and information sciences	Health sciences	Business management	Engineering, architecture and science technologies	Computer and information sciences	Engineering, architecture and science technologies	Protective services
Engineering technologies	Communications and design	Business support	Business support	Consumer services	Computer and information sciences	Engineering, architecture and science technologies

Derived from table 24.

Health Science placing as the top postsecondary career cluster implies a well-defined career path. Studies in manufacturing, construction, repair, and transportation at the certificate level are more prevalent than at the Associate's degree level. Throughout postsecondary education, students are choosing career clusters in which math and science knowledge requirements as prerequisites for employment are increasing.

Looking Forward to 2018: Employment Projections for CTE

This chapter examines the demand for postsecondary education with a particular emphasis on middle-skill jobs (workers requiring education beyond high school but less than a Bachelor's degree). This segment of postsecondary education is of particular interest to colleges that work with high school and industry partners to develop CTE programs.

A Methodological Note: Settle on a Crosswalk First

Providing current and future employment demand by minimum education requirements for employment and by career clusters depends on how occupational information, coded by the Standard Occupational Classification, is aggregated into the different career clusters. Career clusters are aggregated from coursework and programs, coded by the Classification of Instructional Programs, on the education supply side. Connecting education programs to employment information requires the development of crosswalks; settling on one is important prior to developing any estimation of future employment. This section uses the crosswalk developed by the Office of Vocational Education (OVAE), U.S. Department of Education because the CTE community has used this crosswalk since it was first developed in 2006. A note of caution: Since a particular crosswalk is used to develop the information in this section, it should be interpreted narrowly within the scope of that crosswalk.

Size, educational characteristics, and trends in employment in CTE career clusters

Occupations have been assigned to one of 16 career clusters, which states and local recipients of Perkins IV funds have used as a basis for creating POS. There are numerous differences between these 16 career clusters and the Standard Occupational Classification (SOC) codes that are widely used by national statistical agencies. SOC codes are not hierarchical; they provide only loose relationships between occupational categories. The 16 career clusters are a more reasoned attempt to organize occupations by industry with similar education requirements.

For example, STEM occupations as defined by the SOC are divided into two career clusters. Computer-related occupations are found in their own career cluster: Information Technology. The STEM career cluster is limited to scientists, engineers, mathematicians, and related science and engineering technicians. It does not include teachers, professors, or information technology professionals. In another example, actuaries are placed in the Finance career cluster and removed from mathematical occupations (a subdivision of STEM in SOC codes).^a

NOTE:

a. These occupational clusters by SOC code are assigned by the SOC/Perkins crosswalk, table 7. See Appendix A.

It is helpful to look at the relative size and projected employment growth of the 16 career clusters between 2008 and 2018. Overall demand for postsecondary education is driven by the demand for individual occupations as well as the demand for particular skill sets that require longer periods of study to acquire knowledge and demonstrate competency through practice. Although most people look at growth and development through the lens of an industry, the occupational mix within each industry drives the demand for education, skills, and training. The following discussion of the expected growth of career clusters and the education requirements of those occupations is therefore undergirded by trends in industry growth through time.

Based on the size of employment in 2008, the top three career clusters (Business, Management, and Administration; Marketing, Sales, and Service; and Hospitality and Tourism) are expected to continue to grow and retain their top ranking in terms of total numbers of jobs (table 26). Given their considerable size, merely average growth rates will put these career clusters near the top of the ranking, adding the most jobs by 2018. International competition for Business, Management, and Administration; and Marketing, Sales and Service gives rise to the human capital needs necessary to meet increasing industry complexity. Post-recession spending in the Hospitality and Tourism industry is reflected in the projected growth rate.

Table 26. Through 2018, Business, Management, and Administration; Marketing, Sales, and Service; and Hospitality and Tourism will grow and remain the largest career clusters.

Career cluster	2008		2018		DIFFERENCE 2008-2018		RANKING	
	Total employment	Rank	Total employment	Rank	Change in employment	Change in employment (%)	Largest growth	Fastest rate of growth
Business, Management, and Administration	22,400,000	1	23,847,200	1	1,447,200	6	4	12
Marketing, Sales, and Service	20,139,800	2	22,377,400	2	2,237,600	11	3	7
Hospitality and Tourism	18,413,100	3	20,693,800	3	2,280,700	12	2	6
Manufacturing	12,213,700	4	12,032,700	6	(181,000)	-1	16	16
Transportation, Distribution, and Logistics	12,153,600	5	12,624,900	5	471,300	4	10	14
Health Science	11,069,500	6	13,444,800	4	2,375,300	21	1	2
Architecture and Construction	10,317,800	7	11,061,400	8	743,600	7	8	11
Education and Training	9,717,600	8	11,085,800	7	1,368,200	14	5	5
Agriculture, Food, and Natural Resources	6,052,400	9	6,221,200	10	168,800	3	13	15
Human Services	5,515,800	10	6,587,400	9	1,071,600	19	6	3
Law, Public Safety, Corrections, and Security	4,602,500	11	5,262,400	11	659,900	14	9	4
Finance	4,216,400	12	4,629,400	12	413,000	10	11	8
Information Technology	3,518,300	13	4,335,500	13	817,200	23	7	1
Science, Technology, Engineering, and Mathematics	2,660,600	14	2,911,100	14	250,500	9	12	9
Arts, A/V Technology, and Communications	2,190,800	15	2,296,700	15	105,900	5	15	13
Government and Public Administration	1,897,200	16	2,039,700	16	142,500	8	14	10
TOTAL	147,079,100		161,451,400		14,372,300	10		

SOURCE: The Georgetown University Center on Education and the Workforce forecast of educational demand through 2018

Looking Forward to 2018: Employment Projections for CTE

¹² Occupational Employment Statistics Program, May 2009, <http://data.bls.gov/oes/>, Total Community and Social Service occupational employment = 1,891,320. Public = 766,980.

Manufacturing, the fourth-largest career cluster, displays a much different outlook. Due to increases in productivity and offshoring, employment in this career cluster is expected to show very little change over the next decade from 2008, when the recession substantially reduced job availability. Manufacturing drops to sixth place in terms of the size of its contribution to overall jobs by 2018 and has been replaced by Health Science in the fourth position.

Three other career clusters display a similar pattern driven by an increase in productivity: Transportation, Distribution, and Logistics; Architecture and Construction; and Agriculture, Food and Natural Resources. Further consolidation of Transportation, Distribution, and Logistics providers is a practical response to growing competition but stifles employment growth. The construction industry faces a surplus of housing in the real estate market that will limit new residential construction. Employment demand in this industry will rely on remodeling and public-sector investment in infrastructure. The construction industry is also affected by technological advances that improve productivity and limit employment growth. The agriculture and natural resource extraction industry is expected to continue to value real capital over human capital, leading to further mechanization of labor.

Health Science stands out among all career clusters. This medium-large career cluster is projected to rank first in the number of jobs added and second in growth rate through 2018. Only the much smaller Information Technology career cluster is projected to grow faster than Health Science. Investment and innovation in the health science industry will keep pace with the increasing demands of America's aging baby boomers. Information Technology is the driving force of innovation behind the efficiency initiatives of all career clusters.

Other career clusters with high rankings in both numbers of jobs and rate of growth are Education and Training; Human Services; and Law, Public Safety, Corrections, and Security. All three career clusters feature occupations that rely to a great degree on public financing; cutbacks in government budgets at all levels will almost certainly affect projected growth. For example, in Human Services, which is expected to show significant growth by 2018 to meet the growing demands of an aging population, 40 percent of community and social service occupations (e.g., counselors and social workers) are located in public agencies, schools, or medical facilities.¹² Government and Public Administration also reflects

slower than average growth, though administrators will be needed to ensure compliance with regulatory measures and properly manage recovery and investment initiatives. Regulatory measures will create demand for workers in Education and Training to meet higher standards for school performance; in Law, Public Safety, Corrections, and Security, to navigate highly complex litigation on behalf of corporations and individuals and in Public Safety and Security due to increasing requirements for local, state, and national security. Similarly, moderate job growth is expected for the relatively small Finance career cluster to evaluate and manage financial risks in both the public and private sectors. Finance is growing in importance and complexity because of significant changes to financial regulations in the aftermath of the recession.

STEM ranks relatively low, which may be surprising given the attention and emphasis it has received during the past decade. Although science and engineering occupations are critical to ongoing research, development, innovation, and application, the actual number of jobs in these fields is relatively small. Demand for engineers is also closely tied to trends in the manufacturing industry: limited growth may cause many trained engineers and scientists to move into other industries, such as professional and technical services, and into other occupations, such as management, marketing, and sales. It may be more helpful to view science and math expertise as a basic skill valuable both to the economy as a whole and to a larger number of occupations beyond STEM.

Among the career clusters to receive poor job growth rankings is Arts, A/V Technology, and Communications, mostly due to the availability of digital media equipment and the shift from print media (e.g., newspapers) to online and social media. Career clusters with large job growth or fast job growth usually require postsecondary education (table 27).

Looking Forward to 2018: Employment Projections for CTE

Table 27. Career clusters with large job growth or fast growth increasingly require postsecondary education.

Career cluster	TOTAL EMPLOYMENT, 2008 (%)					TOTAL EMPLOYMENT, 2018 (%)					UPSILLING, 2008-2018 (% CHANGE IN EMPLOYMENT)	
	High school diploma or less	Some college/no degree or Associate's degree ^a	Bachelor's degree or better	Total some college or better	Total post-secondary rank	High school diploma or less	Some college/no degree or Associate's degree ^a	Bachelor's degree or better	Total some college or better	Total post-secondary rank	Some college/no degree or Associate's degree ^a	Bachelor's degree or better
Information Technology	7	24	69	93	1	6	22	73	94	1	13	30
Education and Training	9	15	76	91	2	8	15	77	92	2	18	15
Science, Technology, Engineering, and Mathematics	11	25	64	89	3	10	21	69	90	3	-7	19
Health Science	20	36	45	80	4	17	35	48	83	5	20	29
Finance	20	30	50	80	5	14	29	57	86	4	6	25
Law, Public Safety, Corrections, and Security	23	36	41	77	6	17	39	44	83	6	23	22
Arts, A/V Technology, and Communications	24	26	50	76	7	21	24	55	79	8	-4	17
Business, Management, and Administration	26	33	41	74	8	19	33	48	81	7	5	27
Government and Public Administration	32	36	32	68	9	29	34	37	71	9	3	24
Human Services	35	29	36	65	10	30	31	39	70	10	30	29
Marketing, Sales, and Service	43	31	26	57	11	41	32	27	59	11	15	18
Agriculture, Food, and Natural Resources	58	20	23	42	12	56	19	25	44	12	-2	13
Manufacturing	62	28	9	38	13	57	32	11	43	13	10	16
Hospitality and Tourism	63	24	13	37	14	60	25	15	40	14	15	28
Transportation, Distribution, and Logistics	63	27	10	37	15	62	29	10	38	15	9	4
Architecture and Construction	65	24	11	35	16	66	23	11	34	16	3	6

^a Some college includes postsecondary vocational certificates.

Before looking at specific career clusters, a few general observations may help explain the level and growth of employment for postsecondary education. First, since 2008, nearly three of five jobs in the U.S. employ workers with some postsecondary education, and the share is projected to increase to 63 percent by 2018. On the other hand, the share of total employment for workers with a high school diploma or less is projected to decrease slightly from 41 percent in 2008 to 37 percent in 2018.

Second, for many career clusters the share of jobs for workers with a high school diploma or less is large in 2008 and will remain so in 2018. Nevertheless, the overall share of employment for these workers will decrease in all career clusters by 2018, except for Architecture and Construction, where there is a very slight increase. This assumption might imply the continued availability of employment for workers seeking jobs straight out of high school, however, for this assumption to remain true, two conditions must be met. First, solid and substantial high school CTE programs must provide not only solid academics but also offer state-of-the-art training. With increasing academic requirements at the high school level, students have fewer opportunities to enroll in and complete full-fledged CTE programs. Second, even where good high school CTE programs exist, employers often require not only a high school diploma but also an industry certification. Bureaucratic and budgetary constraints, however, make the provision of third-party industry certifications difficult for many schools and districts.

In 2008 the overall share of employment for workers with some college/no degree or an Associate's degree was slightly less than the share for workers with a Bachelor's degree or better. This gap is projected to widen somewhat by 2018. The increase in the share of employment for workers with postsecondary education is projected to occur in occupations requiring a Bachelor's degree or better, increasing from 31 percent in 2008 to 35 percent in 2018. The share of employment requiring some college/no degree or an Associate's degree is projected to remain at 28 percent. This difference is also reflected in upskilling rates, which show the growth rate for a Bachelor's degree or better as twice that of some college/no degree or an Associate's degree. Meanwhile, employment in occupations requiring high school or less is projected to show little growth or will decline. Even with replacement demand, the employment prospects for workers who do not complete high school and some postsecondary education will be difficult overall with few exceptions.

Fourth, there is much less variation predicted in the share of employment for workers with some college/no degree or an Associate's degree (range

from 15% to 39%) than for workers with a Bachelor's degree or better (range from 10% to 77%) or a high school diploma or less (range from 7% to 65%).

Earlier, we identified several career clusters that were projected to add the most jobs or grow rapidly. A leader in both of these measures was Health Science. Health Science is also projected to have a much faster than average rate of upskilling in the middle-skill category. Because of the complexity and importance of dealing with patient health and safety, many healthcare occupations have national educational program standards and licensing requirements. Registered nurse is the largest health care occupation in terms of jobs; most individuals enter the field by completing an Associate's degree. The same is true for many allied health occupations, such as diagnostic technicians and therapy assistants; these careers have a smaller employment size but are still expected to show rapid growth due to the increased demand for health care.

Several widely held occupations in Law, Public Safety, Corrections, and Security are licensed and require the completion of an approved postsecondary education program to be eligible to take the licensing exam. Although fewer occupations are licensed in Government and Public Administration, the common use of civil service exams may have created a workforce with somewhat higher education levels.

The fastest-growing career cluster, Information Technology, is also the cluster with the highest overall share of postsecondary employment, most of which requires a Bachelor's degree or better. Although the employment share for workers with some college/no degree or an Associate's degree is not projected to grow nearly as fast as the share for workers with a Bachelor's degree or better, shorter-length programs may still have an important role: providing technical skill updates or providing workers with a Bachelor's degree in another career cluster (e.g., business) if the workers have initial technical skills.

The number of graduates in Information Technology dropped sharply during the years following the dot-com collapse and amid the increasing trend in off-shoring jobs in programming. Enrollment has rebounded somewhat, but increased demand for new graduates with skills in new applications plus business skills has led to a shortage of employees,

problem-solving, and technical-skill gaps, particularly in areas requiring database managers, software developers, and architects (Cooney, 2011).

Human Services also ranks high for projected job growth rate. The upskilling rate for workers with some college/no degree or an Associate's degree is the highest of any of the career clusters (30%), nearly three times the average. Law, Public Safety, Corrections, and Security has the second-fastest upskilling rate for workers with the some college/no degree or an Associate's degree. Law, Public Safety, Corrections, and Security is projected to be the fourth-fastest growing career cluster for employment. Although workers could previously enter many occupations with just a high school diploma, they are increasingly required to have at least some college/no degree, making it even more difficult for high school graduates to obtain employment in the public sector. Thus, the career clusters with large job growth or fast growth have (a) high shares of postsecondary employment or (b) rapid postsecondary upskilling rates.

The career clusters projected to grow at a slow rate or add few jobs (Manufacturing; Hospitality and Tourism; Transportation, Distribution, and Logistics; and Architecture and Construction) show a similar relationship: these career clusters have below-average shares of employment in the two postsecondary categories. In all four career clusters, the share of employment that requires postsecondary education is less than 50 percent.

Two important items, however, affect projected changes in employment. First, in Manufacturing, the share of employment for workers with some college/no degree, an Associate's degree or a Bachelor's degree is projected to increase. This trend reflects the continuing shift toward automation and production organization that requires individuals to possess problem-solving, math, and communication skills. Second, similar but smaller increases are projected for Hospitality and Tourism; and Transportation, Distribution, and Logistics. Hospitality and Tourism is projected to be among the highest ranked career clusters in the number of jobs added.

For the number of jobs in each career cluster by education, two categories of particular interest to the CTE community are some college/no degree and Associate's degree (table 28). Business, Management, and Administration ranks first overall. It is also first for workers with some college/no degree, an Associate's degree, or a Bachelor's degree and second for workers with a Master's degree or better. Health Science has the largest number of jobs for incumbent workers with an Associate's degree.

Looking Forward to 2018: Employment Projections for CTE

Table 28. Business, Management, and Administration ranks first overall for the total number of jobs in 2018.

Career cluster	NUMBER OF JOBS AND RANK BY EDUCATION													
	Total employment		Less than high school		High school diploma		Some college/ no degree ^a		Associate's degree		Bachelor's degree		Master's degree or better	
	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank
Business, Management, and Administration	23,846,400	1	565,000	7	3,946,200	6	4,790,200	1	3,017,500	2	8,431,100	1	3,096,500	2
Marketing, Sales, and Service	22,377,500	2	1,933,900	4	7,170,600	2	4,718,500	2	2,410,500	3	5,261,000	2	883,000	7
Hospitality and Tourism	20,692,600	3	4,361,000	1	8,114,000	1	3,238,000	3	1,886,000	4	2,734,800	5	358,900	11
Health Science	13,443,700	4	334,200	9	1,957,000	7	1,687,200	6	3,068,300	1	3,496,100	4	2,901,000	3
Transportation, Distribution, and Logistics	12,624,200	5	2,060,900	3	5,718,000	3	2,338,800	4	1,273,500	6	1,109,400	12	123,500	16
Manufacturing	12,031,100	6	1,799,700	5	5,099,400	4	2,327,600	5	1,475,100	5	1,146,500	11	182,800	14
Education and Training	11,086,700	7	61,000	11	771,900	11	875,900	10	800,900	10	4,305,400	3	4,271,700	1
Architecture and Construction	11,065,700	8	2,942,700	2	4,317,900	5	1,474,600	7	1,081,100	7	1,005,000	15	244,400	12
Human Services	6,587,100	9	453,500	8	1,503,000	9	1,144,600	9	916,200	8	1,499,100	8	1,070,600	5
Agriculture, Food, and Natural Resources	6,221,500	10	1,698,300	6	1,815,500	8	696,000	12	459,000	12	1,091,500	13	461,300	10
Law, Public Safety, Corrections, and Security	5,260,900	11	55,300	12	850,600	10	1,188,200	8	867,600	9	1,178,600	10	1,120,600	4
Finance	4,629,500	12	46,100	13	592,600	13	795,600	11	559,800	11	2,100,300	7	535,100	9
Information Technology	4,335,000	13	22,600	14	223,700	16	535,300	13	409,800	14	2,162,700	6	980,900	6
Science, Technology, Engineering, and Mathematics	2,912,100	14	—	16	281,100	15	205,700	16	415,800	13	1,231,000	9	778,500	8
Arts, A/V Technology, and Communications	2,296,800	15	123,800	10	350,300	14	284,000	15	268,700	15	1,033,700	14	236,300	13
Government and Public Administration	2,040,700	16	—	15	593,300	12	468,100	14	228,700	16	580,000	16	170,600	15

SOURCE: The Georgetown University Center on Education and the Workforce forecast of educational demand through 2018

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

The projected educational demand across occupations or career clusters permits CTE planners to compare each career cluster's share of total employment to its share of total employment by educational attainment (tables 29–30). If the educational attainment share exceeds the share of total employment, the particular career cluster has a higher than average demand for workers with that level of education. For example, employment in Health Science comprises 8 percent of total employment in all occupations regardless of education level but is projected to comprise 16 percent of total employment of all workers with an Associate's degree. Consequently, one may conclude that Health Science is a source of high demand for workers with an Associate's degree. The other career clusters with a high demand for workers with an Associate's degree are Business, Management, and Administration; Manufacturing; Human Services; and Law, Public Safety, Corrections, and Security.

Table 29. Hospitality and Tourism ranks first for workers with high school or less; Business, Management, and Administration is first for those with some college/no degree.

	TOTAL EMPLOYMENT		LESS THAN HIGH SCHOOL		HIGH SCHOOL DIPLOMA		SOME COLLEGE/NO DEGREE ^a	
Career cluster	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank
Business, Management, and Administration	15	1	3	7	9	6	18	1
Marketing, Sales, and Service	14	2	12	4	17	2	18	2
Hospitality and Tourism	13	3	26	1	19	1	12	3
Health Science	8	4	2	9	5	7	6	6
Transportation, Distribution, and Logistics	8	5	13	3	13	3	9	4
Manufacturing	7	6	11	5	12	4	9	5
Education and Training	7	7	0	11	2	11	3	10
Architecture and Construction	7	8	18	2	10	5	6	7
Human Services	4	9	3	8	3	9	4	9
Agriculture, Food, and Natural Resources	4	10	10	6	4	8	3	12
Law, Public Safety, Corrections, and Security	3	11	0	12	2	10	4	8
Finance	3	12	0	13	1	13	3	11
Information Technology	3	13	0	14	1	16	2	13
Science, Technology, Engineering, and Mathematics	2	14	0	16	1	15	1	16
Arts, A/V Technology, and Communications	1	15	1	10	1	14	1	15
Government and Public Administration	1	16	0	15	1	12	2	14
TOTAL	100		100		100		100	

SOURCE: The Georgetown University Center on Education and the Workforce

^a Some college includes postsecondary vocational certificates.

Table 30. Health Science ranks first for an Associate's degree; Business, Management, and Administration, for a Bachelor's degree; Education and Training, for a Master's degree or better.

	ASSOCIATE'S DEGREE		BACHELOR'S DEGREE		MASTER'S DEGREE OR BETTER	
Career cluster	(%)	Rank	(%)	Rank	(%)	Rank
Business, Management, and Administration	16	2	22	1	18	2
Marketing, Sales, and Service	13	3	14	2	5	7
Hospitality and Tourism	10	4	7	5	2	11
Health Science	16	1	9	4	17	3
Transportation, Distribution, and Logistics	7	6	3	12	1	16
Manufacturing	8	5	3	11	1	14
Education and Training	4	10	11	3	25	1
Architecture and Construction	6	7	3	15	1	12
Human Services	5	8	4	8	6	5
Agriculture, Food, and Natural Resources	2	12	3	13	3	10
Law, Public Safety, Corrections, and Security	5	9	3	10	6	4
Finance	3	11	5	7	3	9
Information Technology	2	14	6	6	6	6
Science, Technology, Engineering, and Mathematics	2	13	3	9	4	8
Arts, A/V Technology, and Communications	1	15	3	14	1	13
Government and Public Administration	1	16	2	16	1	15
TOTAL	100		100		100	

SOURCE: The Georgetown University Center on Education and the Workforce forecast of educational demand through 2018

Examining the projected distribution of educational by career cluster permits CTE planners to compare all career clusters and identify the cluster with high demand for some college/no degree or an Associate's degree (table 31). The data are national, but the data for states or sub-state regions should be comparable because they are occupational rather than industrial. For example, the top three career clusters for occupations with high demand for workers with an Associate's degree are Health Science (23%); Law, Public Safety, Corrections, and Security (16%); Human Services (14%); and STEM (14%).

Table 31. For educational demand in 2018, Agriculture, Food, and Natural Resources ranks first for workers with less than high school; Transportation, Distribution, and Logistics for a high school diploma; Government and Public Administration for some college/no degree; Health Science for an Associate's degree; Information Technology for a Bachelor's degree; and Education and Training for a Master's degree or better.

Career cluster	LESS THAN HIGH SCHOOL		HIGH SCHOOL DIPLOMA		SOME COLLEGE/NO DEGREE ^a		ASSOCIATE'S DEGREE		BACHELOR'S DEGREE		MASTER'S DEGREE OR BETTER		TOTAL (%)
	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	
Agriculture, Food, and Natural Resources	27	1	29	6	11	14	7	15	18	12	7	11	100
Architecture and Construction	27	2	39	4	13	10	10	12	9	15	2	13	100
Arts, A/V Technology, and Communications	5	8	15	11	12	12	12	8	45	3	10	9	100
Business, Management, and Administration	2	10	17	9	20	4	13	5	35	6	13	7	100
Education and Training	1	13	7	15	8	15	7	16	39	5	39	1	100
Finance	1	12	13	13	17	8	12	7	45	2	12	8	100
Government and Public Administration	0	15	29	7	23	1	11	9	28	7	8	10	100
Health Science	2	9	15	12	13	11	23	1	26	8	22	4	100
Hospitality and Tourism	21	3	39	3	16	9	9	14	13	13	2	14	100
Human Services	7	7	23	8	17	7	14	4	23	10	16	6	100
Information Technology	1	14	5	16	12	13	9	13	50	1	23	3	100
Law, Public Safety, Corrections, and Security	1	11	16	10	23	2	16	2	22	11	21	5	100
Manufacturing	15	5	42	2	19	5	12	6	10	14	2	15	100
Marketing, Sales, and Service	9	6	32	5	21	3	11	10	24	9	4	12	100
Science, Technology, Engineering, and Mathematics	0	16	10	14	7	16	14	3	42	4	27	2	100
Transportation, Distribution, and Logistics	16	4	45	1	19	6	10	11	9	16	1	16	100
TOTAL	10		27		17		12		24		11		

SOURCE: The Georgetown University Center on Education and the Workforce forecast of educational demand through 2018

^a Some college includes postsecondary vocational certificates.

Looking Forward to 2018: Employment Projections for CTE

¹³ Postsecondary vocational certificates are also included in this category and are estimated to be between 8 and 9 percent of overall attainment.

Previous tables have compared career clusters in terms of the projected numerical change in employment or rate of change in employment between 2008 and 2018. In addition to the number of job openings created when new businesses start up or existing businesses expand, many job openings are created by replacement demand when a person retires or moves into a different occupation.

Between 2008 and 2018, projections show there will be around 47 million total job openings, which will include about 14 million openings due to growth and 32.4 million openings due to replacement demand.

The projected educational demand for these job openings is as follows:

- Less than high school, 4.6 million (10%);
- A high school diploma but no further education, 13.1 million (27%);
- Middle skills, 14.1 million (30%), including¹³
 - Some college/no degree, 8.4 million (18%) and
 - an Associate's degree, 5.7 million (12%);
- A Bachelor's degree, 11 million (23%); and
- A Master's degree or better, 4.8 million (9%).

Among the top-ranked clusters with job openings for workers with some college/no degree or an Associate's degree, some clusters are familiar and some are new (table 32). Hospitality and Tourism; Business, Management, and Administration; Health Science; and Marketing, Sales, and Service again rank at the top, just as they do for total employment change and employment demand.

Table 32. The increase in job openings for Manufacturing and Transportation, Distribution, and Logistics stems from the large number of workers who will need to be replaced when they retire.

	TOTAL JOB OPENINGS		SHARE OF TOTAL JOB OPENINGS		
	Some college/ no degree or Associate's degree ^a	By 2018	Some college/ no degree or Associate's degree ^a	Job openings for some college/no degree or Associate's degree	
Career cluster	(thousands)	Rank	(thousands)	(%)	Rank
Hospitality and Tourism	2,288	1	8,461	27	11
Business, Management, and Administration	1,842	2	5,519	33	7
Health Science	1,346	3	3,719	36	4
Transportation, Distribution, and Logistics	1,312	4	4,157	32	8
Marketing, Sales, and Service	1,256	5	3,746	34	5
Manufacturing	1,065	6	3,182	33	6
Agriculture, Food, and Natural Resources	845	7	3,050	28	10
Architecture and Construction	724	8	3,191	23	13
Finance	706	9	1,910	37	3
Human Services	680	10	2,286	30	9
Law, Public Safety, Corrections, and Security	672	11	1,681	40	1
Education and Training	483	12	3,120	15	16
Information Technology	308	13	1,453	21	14
Government and Public Administration	238	14	621	38	2
Arts, A/V Technology, and Communications	198	15	772	26	12
Science, Technology, Engineering, and Math	182	16	879	21	15
TOTAL	14,145		47,747	30	

SOURCE: The Georgetown University Center on Education forecast of educational demand through 2018

^a Some college includes postsecondary vocational certificates.

However, two career clusters (Manufacturing; and Transportation, Distribution, and Logistics) are ranked in the top six that have been at the bottom of the rankings of employment change. The noticeable jump in openings in these career clusters is due to the large number of job openings expected because of replacement demand, as the relatively older workforce in these occupational groups retires and is replaced by new workers.

The surprisingly high ranking of Manufacturing; and Transportation, Distribution, and Logistics perhaps partially explains the sometimes strained or confusing relationship that exists among students, CTE programs, and employers when it comes to these career clusters. Over the past decade, students and their parents have heard the constant drumbeat about layoffs in manufacturing and transportation that reached a crescendo during the recession. Consequently, interest in enrolling in educational programs for these occupations has waned. Colleges cannot afford to run precision manufacturing programs that serve very small numbers of students, so fewer such programs exist. Employers, on the other hand, are often quoted as saying they have job openings they can't fill because there aren't enough qualified workers. This phenomenon is not new, but became more common in 2010 as manufacturers increased production during the first stirrings of economic recovery. The demand for skilled workers reflects both the demand to replace older, experienced, high-skill workers and the demand for young, less expensive workers with the new skills required to handle new technology.

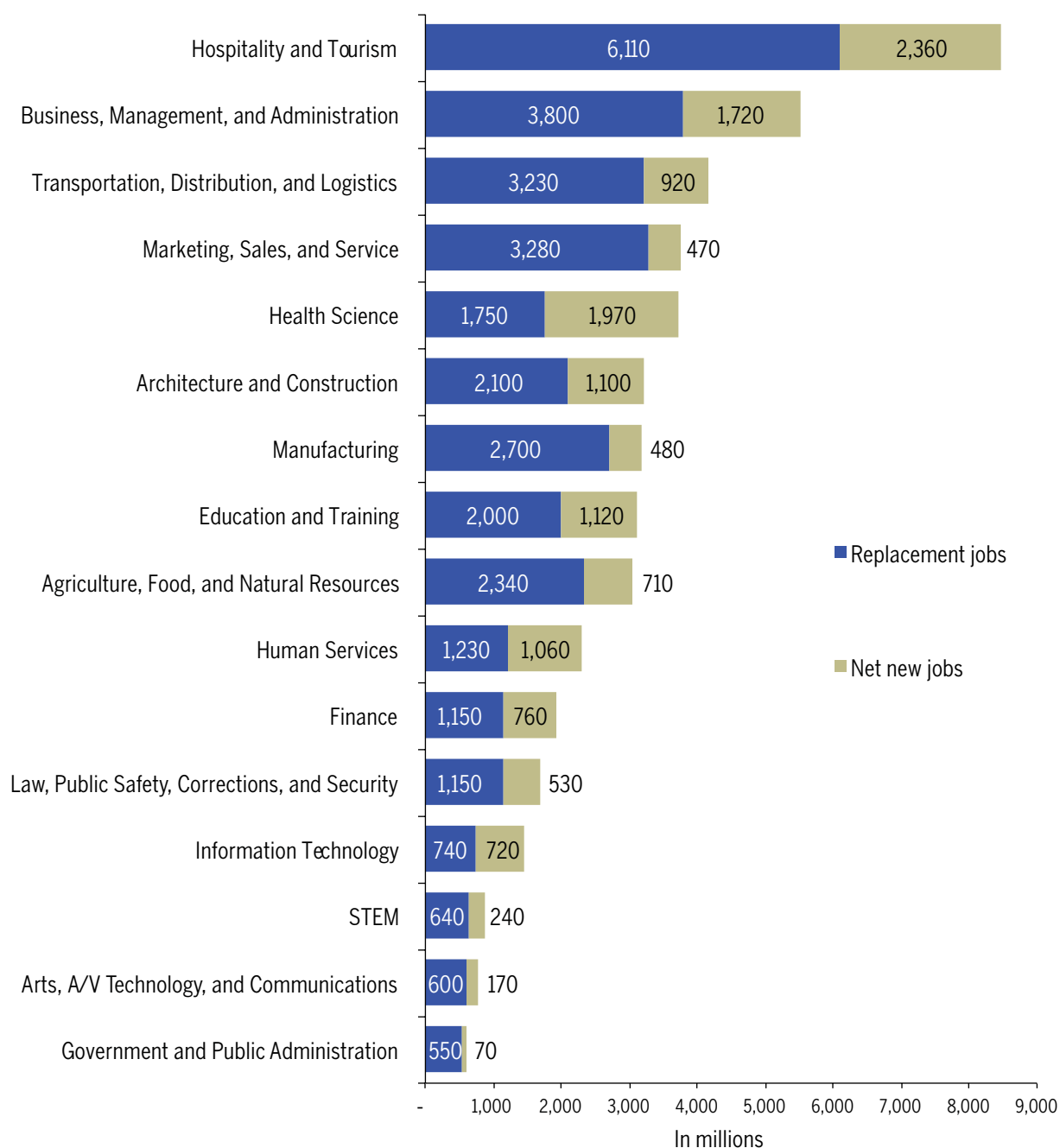
The some college/no degree and Associate's degree share of total job openings and the rank for each career cluster reveal several interesting findings. The three career clusters with the highest share of some college/no degree and Associate's degree job openings (Law, Public Safety, Corrections, and Security; Government and Public Administration; and Finance) are all in the bottom half of the ranking for total number of openings for middle-skilled workers. For example, Law, Public Safety, Corrections, and Security has the highest-ranked share of some college/no degree and Associate's degree openings (40 percent) but ranked eleventh overall for total number of job openings.

Most career clusters with high rankings for the projected number of total job openings also have above-average shares of some college/no degree and Associate's degree job openings to total job openings. The one exception is Hospitality and Tourism, which ranks first for total job openings by virtue of having high projected growth and high replacement demand as workers move up the career ladder.

Replacement demand significantly affects the total number of projected job openings (figure 2). In addition to high replacement demand in

Transportation, Distribution, and Logistics; and Manufacturing, the figure shows significant replacement demand in Architecture and Construction; and Agriculture, Food, and Natural Resources. A number of factors will have to be monitored as the economic recovery progresses, including the rate at which workers actually retire and new workers are hired.

Figure 2. Most new and replacement jobs will be in Hospitality and Tourism.



Looking Forward to 2018: Employment Projections for CTE

The distribution of total job openings within an education level across the 16 career clusters shows the concentration of job openings (table 33). For example, more than 60 percent of the total job opening demand for workers with some college/no degree and an Associate's degree are in career clusters that rank first through sixth overall (Hospitality and Tourism; Business, Management, and Administration; Transportation, Distribution, and Logistics; Marketing, Sales, and Service; Health Science; and Architecture and Construction).

Table 33. Previous sources of demand for Finance; Government and Public Administration; and Law, Public Safety, Corrections, and Security will not be as strong because budget constraints or technological changes will reduce demand for labor.

Career cluster	TOTAL, ALL EDUCATION LEVELS		LESS THAN HIGH SCHOOL		HIGH SCHOOL DIPLOMA		SOME COLLEGE/NO DEGREE ^a		ASSOCIATE'S DEGREE		BACHELOR'S DEGREE		MASTER'S DEGREE OR BETTER	
	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank
Hospitality and Tourism	18	1	36	1	24	1	18	1	14	2	10	3	3	7
Business, Management, and Administration	12	2	4	7	9	4	14	2	12	3	16	1	6	5
Transportation, Distribution, and Logistics	9	3	12	3	14	2	10	3	8	4	4	11	1	13
Marketing, Sales, and Service	8	4	5	6	8	6	10	4	8	5	9	4	2	10
Health Science	8	5	2	9	4	8	6	7	15	1	9	5	36	1
Architecture and Construction	7	6	16	2	9	5	5	9	5	8	3	12	2	11
Manufacturing	7	7	9	4	10	3	8	5	7	6	3	13	1	14
Education and Training	7	8	0	13	2	12	3	12	4	12	11	2	16	2
Agriculture, Food, and Natural Resources	6	9	8	5	7	7	6	6	6	7	7	6	4	6
Human Services	5	10	3	8	4	9	5	11	5	9	6	8	2	9
Finance	4	11	1	10	4	10	5	8	4	11	5	9	1	12
Law, Public Safety, Corrections, and Security	4	12	0	14	2	11	5	10	5	10	4	10	14	3
Information Technology	3	13	0	15	1	16	2	13	2	13	7	7	3	8
Science, Technology, Engineering, and Math	2	14	0	16	1	15	1	16	2	14	3	15	8	4
Arts, A/V Technology, and Communications	2	15	1	11	1	14	1	15	2	15	3	14	1	16
Government and Public Administration	1	16	0	12	1	13	2	14	2	16	1	16	1	15
TOTAL	100		100		100		100		100		100		100	

SOURCE: The Georgetown University Center on Education forecast of educational demand through 2018

^a Some college includes postsecondary vocational certificates.

The career cluster distribution reflects the national economy. Although the educational attainment characteristics of occupations are fairly similar throughout the country, significant variations occur in occupational makeup when the geographic area is more localized. For example, Health Science is more likely to be a significant career cluster in every region because healthcare services are found throughout a state. Agriculture, Food, and Natural Resources; and Hospitality and Tourism can vary considerably depending on the urban or rural nature of a region or the climate and natural or man-made attractions found there. An analysis of the industries and occupations of a sub-state region, along with trends in education levels required for occupations, should help CTE program planners identify career clusters that may be most important for economic and workforce development in their area.

Examining Wages and Career Clusters

In the Georgetown University Center on Education and the Workforce's *Help Wanted* report (Carnevale et al., 2010), the authors demonstrated the very real earnings returns to postsecondary certificates and degrees. The report also showed postsecondary degrees greatly increase the likelihood that workers will keep and advance in good paying jobs. Although this is true overall, occupational choice also matters in determining pay. People with the same certificates and degrees have different earnings depending on the occupation (and to some extent the industry) in which they work.

In this section, we discuss earnings of workers in the 16 career clusters. We calculate average earnings of career clusters by educational attainment and provide a breakdown of average earnings of career clusters by education level, age-cohort, and sex, detailing average changes in career cluster wages over the last several decades.

Opportunities for high school graduates and high school dropouts still exist. If, however, the wage potential of these jobs is weak, a transition is needed to give workers in these positions hope that they have a way out. Today's CTE curricula are designed to do just that. Many programs offer clear curricular lattices and ladders that facilitate students' progression through successive career goals. Policy prescriptions often recommend the inclusion of bite-sized, stackable certificates that make career goals appear more feasible. However, for many Americans, the connection to economic rewards dominates.

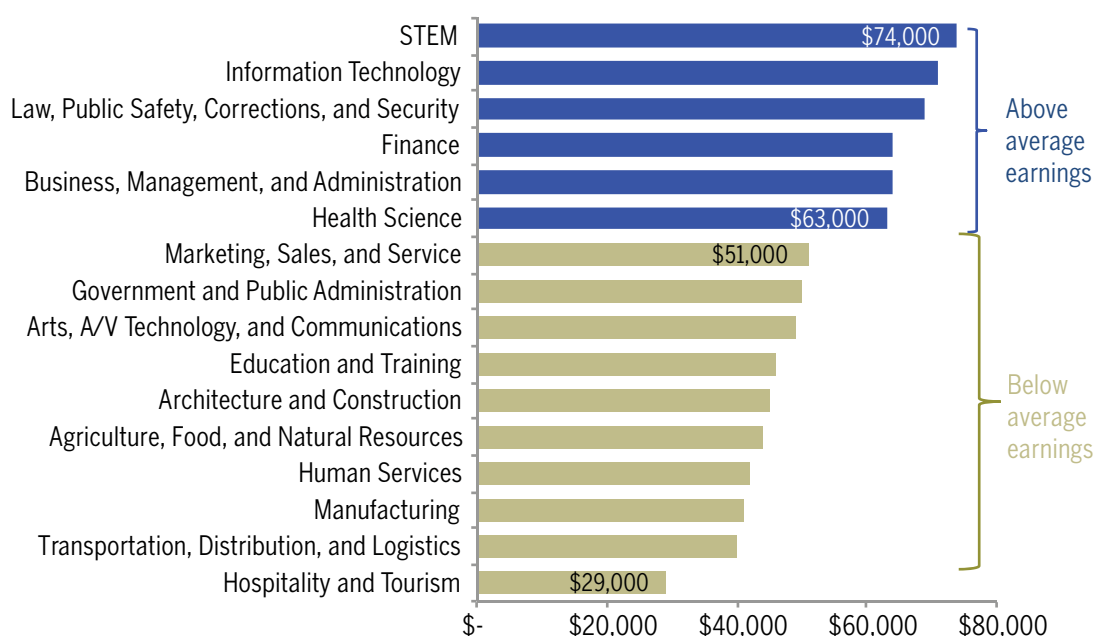
Summary of Wages Findings

- There is a wide distribution of wages across career clusters.
- Across time, wage growth is best in Business, Management, and Administration; Finance; Health Science; Information Technology; and Law, Public Safety, Corrections, and Security.
- Occupation matters.
- STEM and Information Technology are the best-paying career clusters for workers with middle skills.
- The gender wage gap by career cluster ranges between \$2,000 and \$69,000.
- Disaggregating by career clusters and age reveals an occupational bias in the gender wage gap.

There is a wide distribution of wages across career clusters.

STEM pays the highest wages overall, averaging \$74,000 in 2008 (figure 3).¹⁴ Although the distribution of earnings varies within STEM by specific occupations and education levels, on average, wages are relatively stable and high. Engineers are largely responsible for this trend. They tend to have higher base wages at the beginning of their careers with relatively slower growth over time, mostly due to the higher base wage.

Figure 3. STEM prime-age workers earn above-average wages (2009\$)



SOURCE: Authors' analysis of the American Community Survey (2006-2009)

¹⁴ We pooled American Community Survey data (ACS) over 4 years due to sample size considerations.

Information Technology follows with an average annual wage of \$71,000. This career cluster includes computer workers and various subcategories such as computer programmers, software engineers, and systems and database analysts. Law, Public Safety, Corrections, and Security also performs very well at an average of \$69,000 per year. This average is driven by the relatively high earnings of judges and lawyers, although police officers, firefighters, and detectives better reflect the earnings of the largest proportions of workers in this career cluster. Finance; and Business, Management, and Administration show average earnings of \$64,000 per year.

The distribution of workers is very broad within these career clusters. For example, chief executive officers (CEOs), management analysts, and human resources assistants are all found here. As a result, the extremes may either pull up or pull down the average wage. Like Finance, earnings for Health Science are highly skewed for the occupations associated with it. As a group, this career cluster runs the gamut from doctors to nurses' aides.

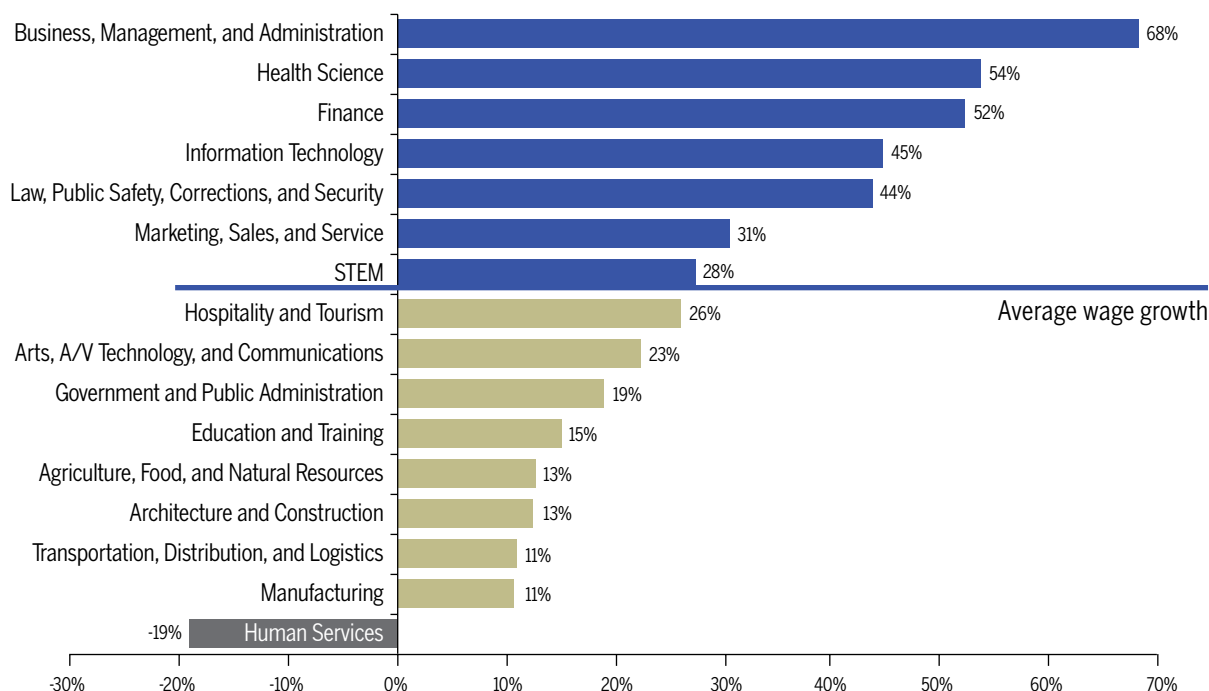
These six career clusters make up 34 percent of all employment in the economy. The remaining 10 career clusters have earnings that are below the average of prime-age workers across all education levels. The three lowest paid career clusters on average are Hospitality and Tourism (\$29,000), Transportation, Distribution, and Logistics (\$40,000), and Manufacturing (\$41,000).

Because the distribution of wages across career clusters is so large, it is often difficult to get a true picture of wages by looking at measures of central tendency (average and median). For this reason, a more detailed wage table at the end of each career cluster presents needed data.

Across time, wage growth is best in Business, Management, and Administration; Finance; Health Science; Information Technology; and Law, Public Safety, Corrections, and Security.

STEM had the seventh highest rate of wage growth between 1983 and 2008 (figure 4). In general, workers paid the highest wages tend to have slower wage growth because they start off at a higher base wage. Healthcare professional and managerial and professional workers in Business, Management, and Administration; and Finance also have higher relative gains in wages over this timeframe.

Figure 4. Seven career clusters experienced above-average real wage growth between the 1980s and the 2000s.



SOURCE: Authors' analysis of pooled CPS data, (1983–1986 and 2006–2009)

The average growth of real wages over the period is 27 percent. Health Science and Business, Management, and Administration experienced growth at least twice the national average or higher. Agriculture, Food, and Natural Resources; Architecture and Construction; Transportation, Distribution, and Logistics; and Manufacturing experienced wage growth of less than half the national average.

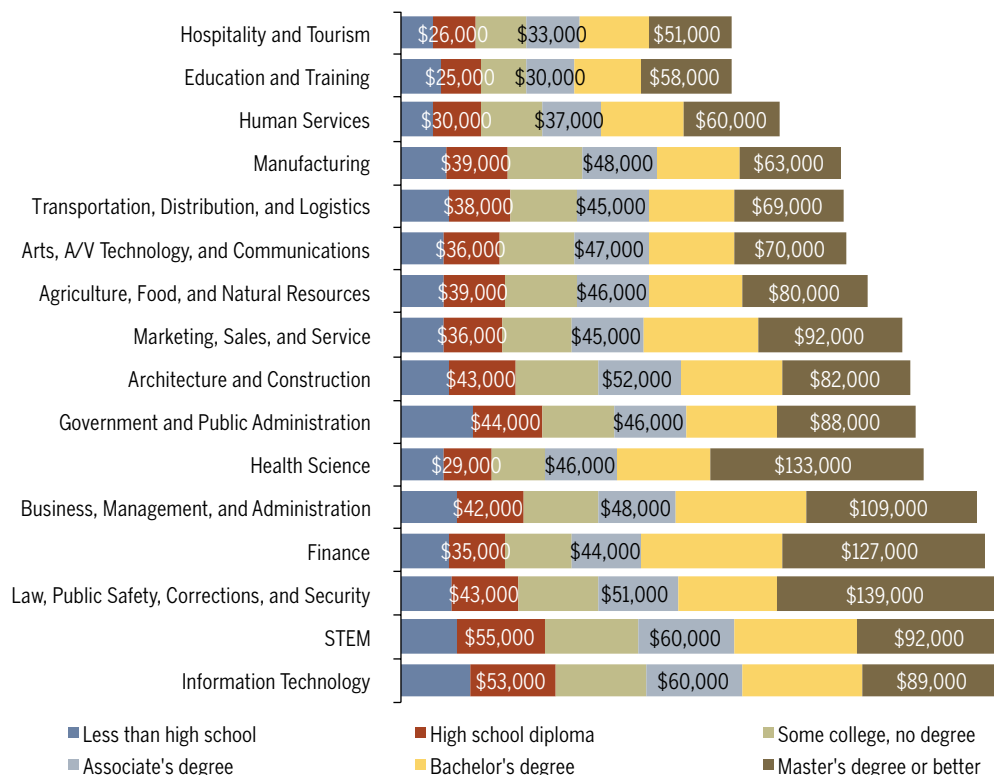
Human Services experienced wage decline over the 30-year time frame. The decline is especially significant because wages in this career cluster are below average; it is the fourth lowest for wages.

Occupation matters.

Although there is a direct correlation between educational attainment and wages, occupational choice also matters (figure 5). This concept is critical to understanding not only the forces that drive educational demand but also what shapes the U.S. job market.

Examining Wages and Career Clusters

Figure 5. Education still determines wages, but occupation also matters.



SOURCE: Authors' Analysis of ACS data, 2006-2009

Although average wages are useful for gauging a worker's placement within a career cluster, they conceal complex relationships between wages and degree choice or between wages and occupational choice. In other words, although education level is highly associated with earnings, other factors are important as well, including the occupation a worker pursues within a particular industry, the kind of degree a worker selects, and a variety of personal traits, interests, and values.

Thirty-one percent of workers with an Associate's degree earn more than the average worker with a Bachelor's degree. Within occupations, the more education a worker has, the better the pay. Across occupations, this relationship is looser; the occupation a worker chooses also matters for the wage outcome.

Hospitality and Tourism, for example, pays the lowest average wages of all 16 career clusters. This relatively low wage threshold occurs at all education levels. A worker in Hospitality and Tourism has to obtain a Master's degree or better to earn the average wage of all 16 career clusters. The same is true for Education and Training; and Human Services. Manufacturing requires only a Bachelor's degree to earn the average wage of all career clusters.

Workers with some college/no degree and/or a postsecondary certificate in Business, Management, and Administration or Manufacturing can earn more than workers with a Bachelor's degree in Hospitality and Tourism or Education and Training.

The difference in earnings by degree level has been superseded by a much broader variation in earnings based on the relationship between curriculum and occupation. Although the difference between the wages for workers with a high school diploma and those with a Bachelor's degree is 84 percent, the difference between the median earnings for the lowest and highest paid workers with a Bachelor's degree is an astounding 314 percent.

STEM and Information Technology are the best-paying career clusters for middle skills.

STEM and Information Technology jobs pay relatively high wages for workers whose highest educational attainment is a high school diploma. These two career clusters often require workers to obtain industry-based certifications or licenses that attest to their ability to perform particular tasks. Unfortunately, no comprehensive data on industry-based certifications are available. The little information available comes from Payscale.com, which relies on a self-reported survey.¹⁵ Of the approximately 200 different certifications listed on the site that a worker is able to obtain, about 35 are either in STEM or Information Technology, with an emphasis on Information Technology. These certifications include certified professional engineer, CompTIA A+ service technician, Microsoft Office specialist, and Excel certification. These certifications are a significant driver influencing wages for STEM and Information Technology even at relatively lower education levels.

The gender wage gap by career cluster ranges between \$2,000 and \$69,000.

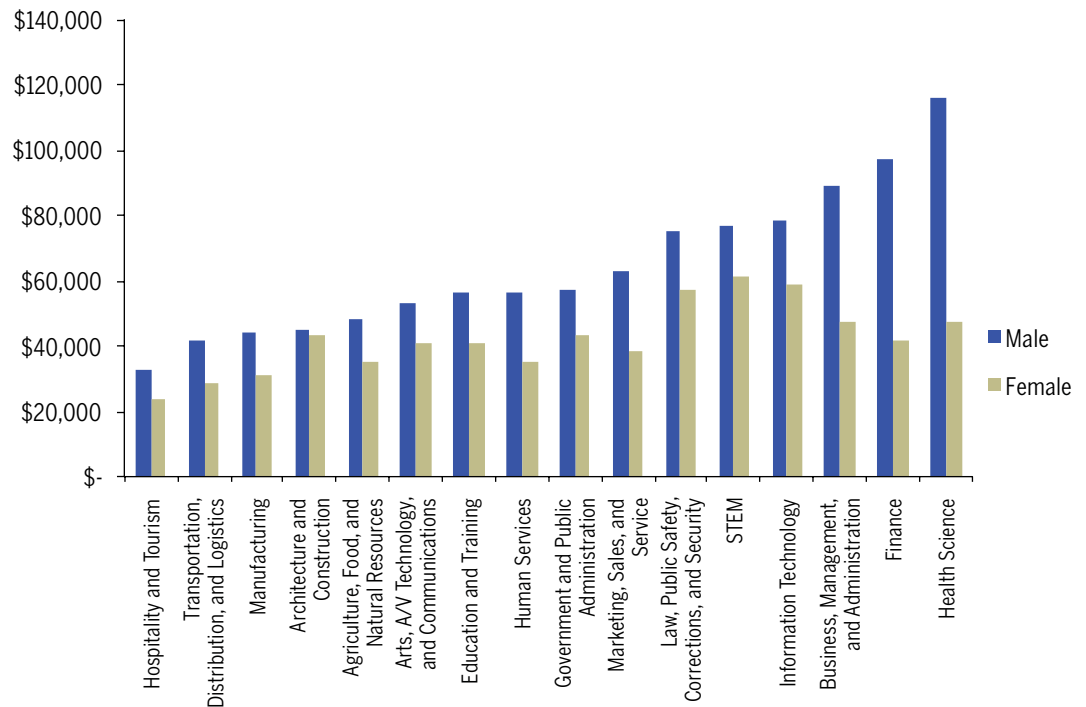
Women earn on average about 76 cents on the dollar compared to men; this is the often-cited gender wage gap (figures 5-7).¹⁶ The size of the gender wage gap is markedly different across career clusters and can be partially explained by occupational choice, labor force participation and experience, and union status. For several nonmonetary reasons, women in the past have avoided high-paying occupations such as engineering, medicine, or finance, a fact reflected in their lower earnings potential. When controlling for variables such as hours worked, occupational choice, skill, experience, and union status, however, the gender wage gap decreases. Blau and Kahn (2007) attribute 27 percent of the differences in earnings between men and women to occupational choices.

¹⁵ Although the Payscale.com database has numerous problems, it contains the best data available on industry-based certifications. However, the database also lists licenses and, in a few rare cases, certificates as certifications.

¹⁶ Women are also more likely than men to work part time. No such distinctions are made in this analysis.

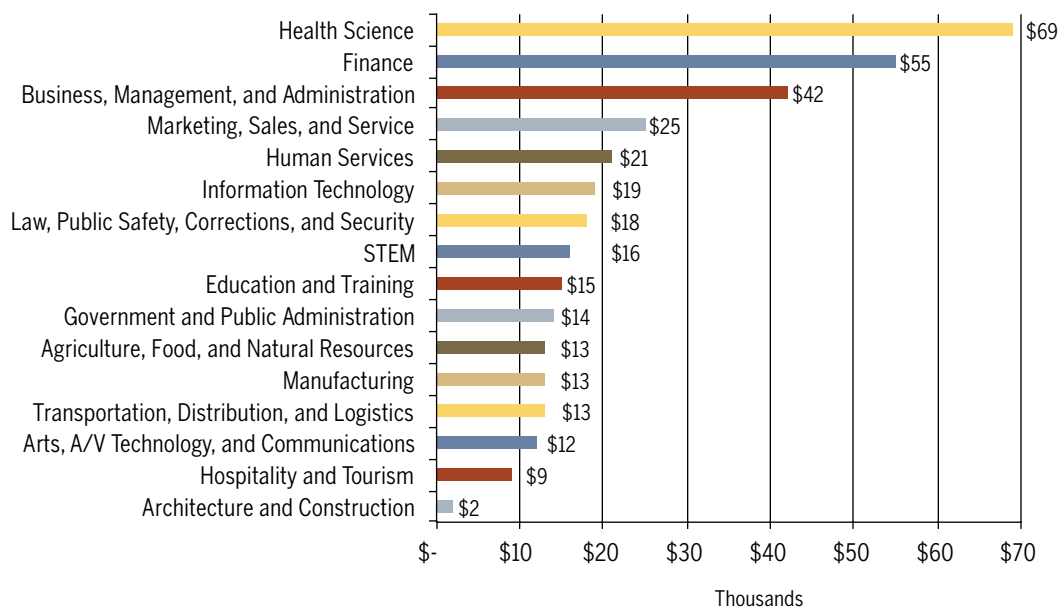
Examining Wages and Career Clusters

Figure 6. The gender wage gap is largest in Finance and Health Science.



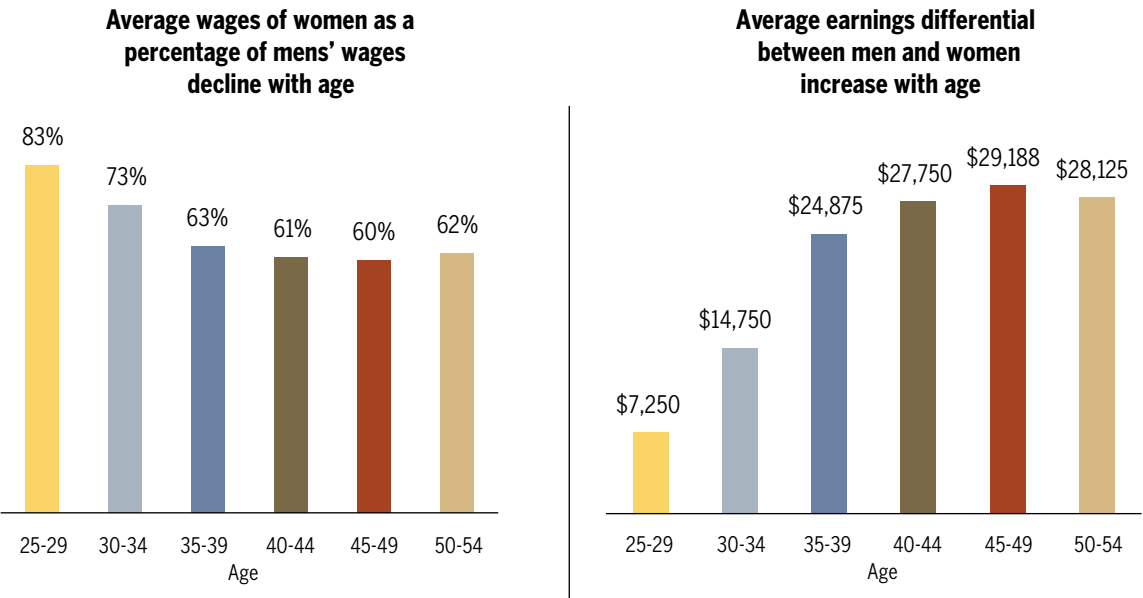
SOURCE: Authors' Analysis of ACS data, 2006-2009

Figure 7. Gender wage gap by career cluster



SOURCE: Authors' Analysis of ACS data, 2006-2009

Figure 8. Women younger than 30 earn about 83 percent as much as men.

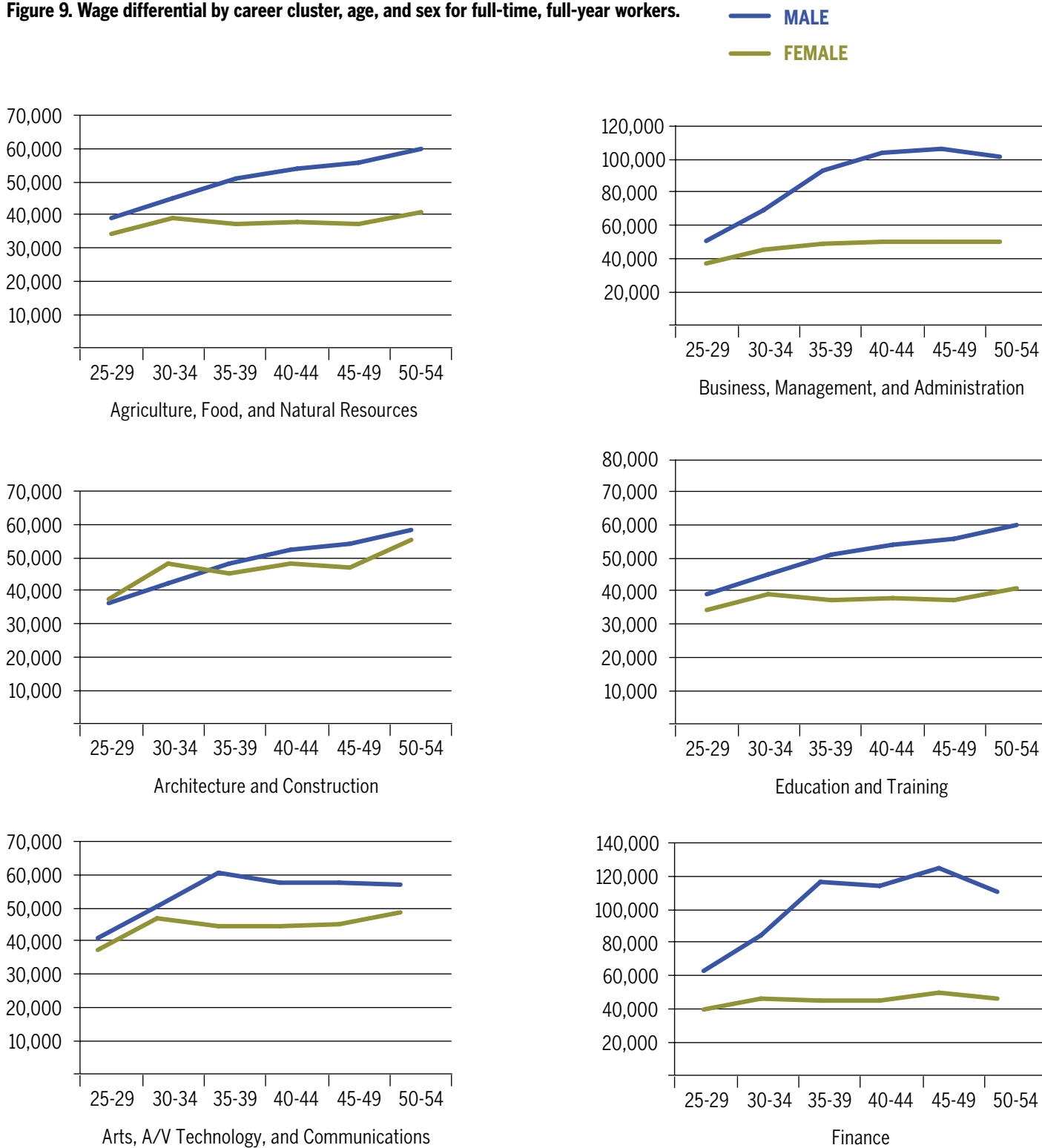


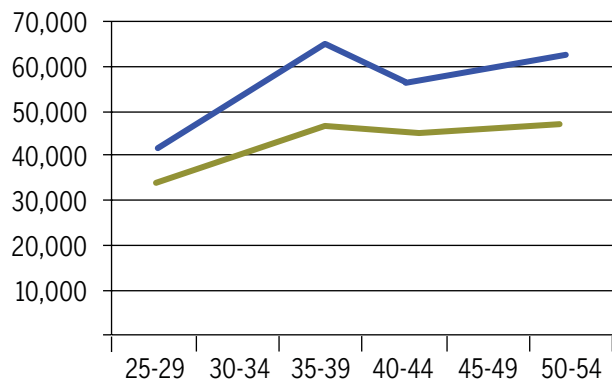
SOURCE: Authors' analysis of ACS data, 2006-2009

The difference in wages between men and women across career clusters ranges from \$2,000 in Architecture and Construction to \$69,000 in Health Science (figure 9). There is little evidence that the gender wage gap closes at higher levels of education. If anything, the reverse is true: the gender wage gap seems to increase with educational attainment.

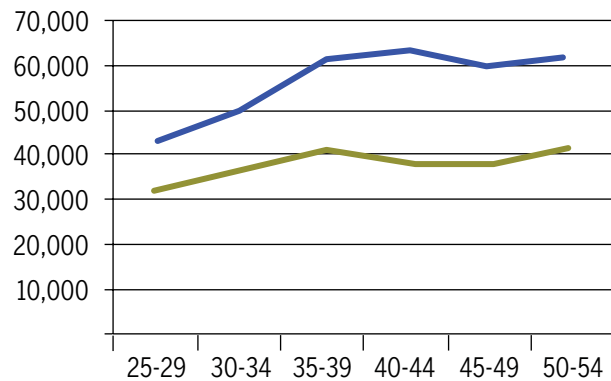
Examining Wages and Career Clusters

Figure 9. Wage differential by career cluster, age, and sex for full-time, full-year workers.

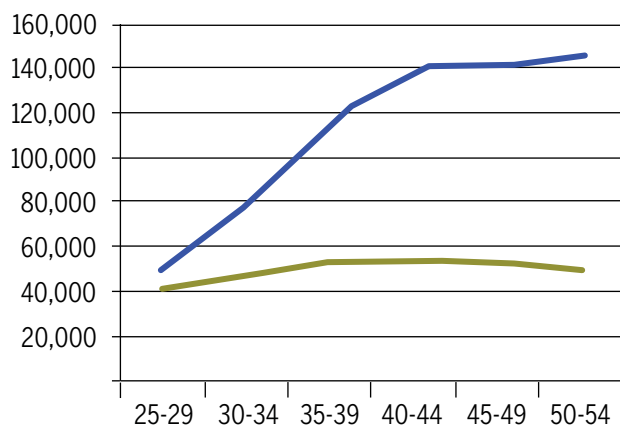




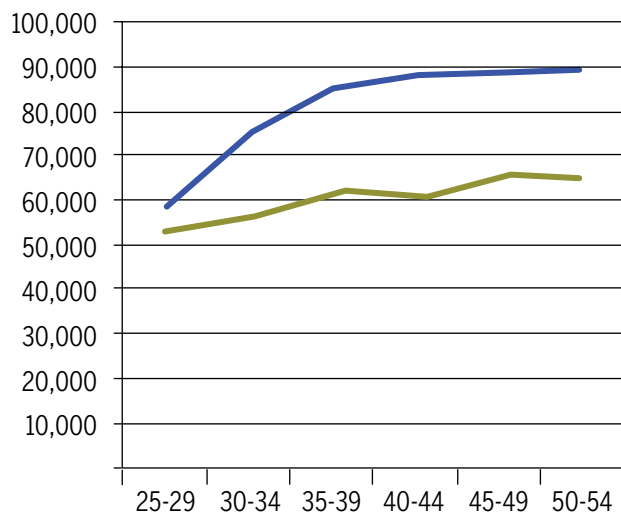
Government and Public Administration



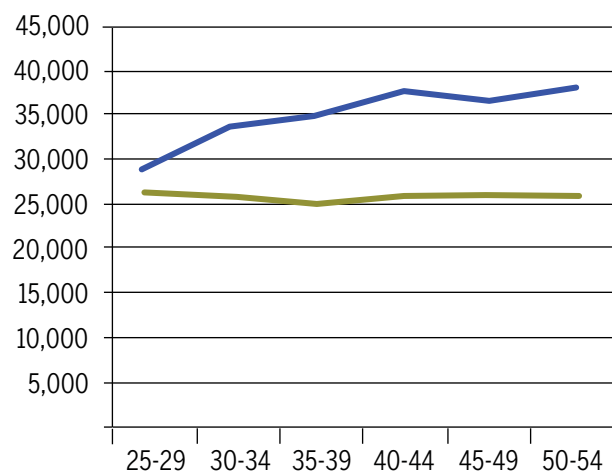
Human Services



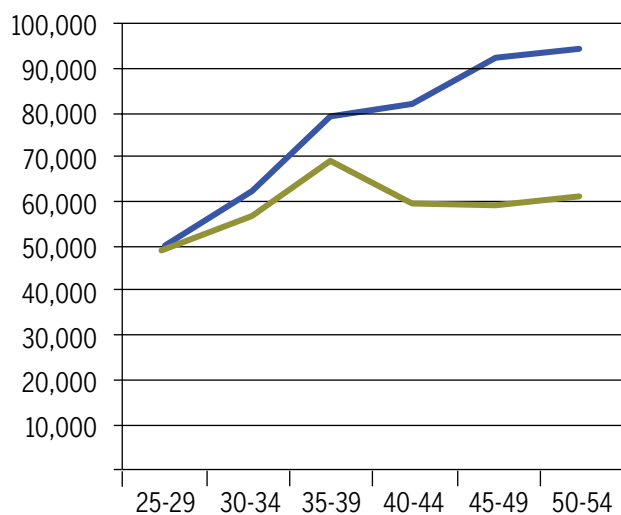
Health Science



Information Technology



Hospitality and Tourism



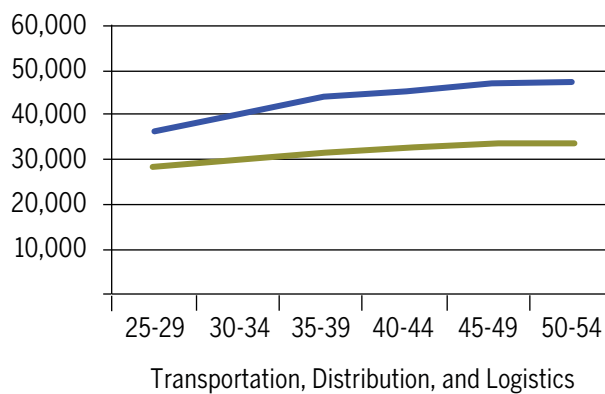
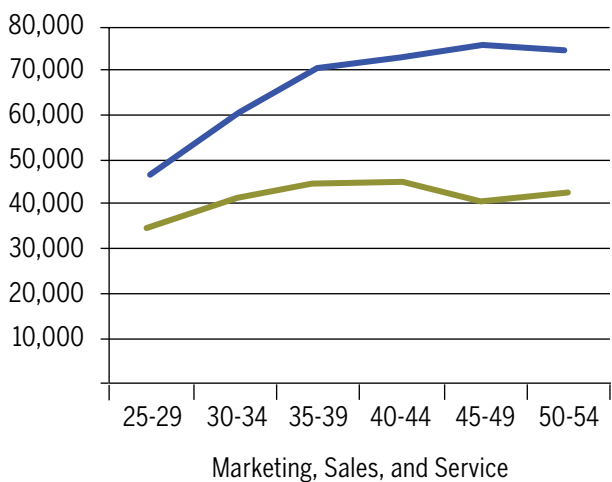
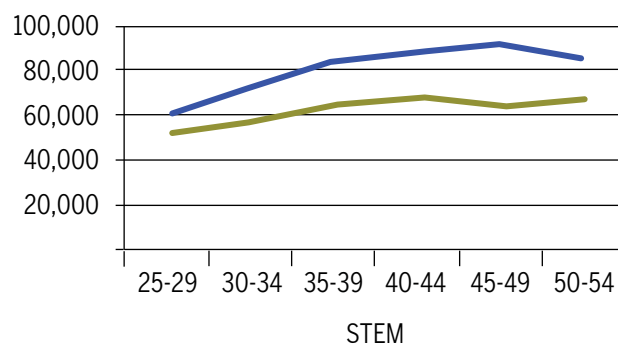
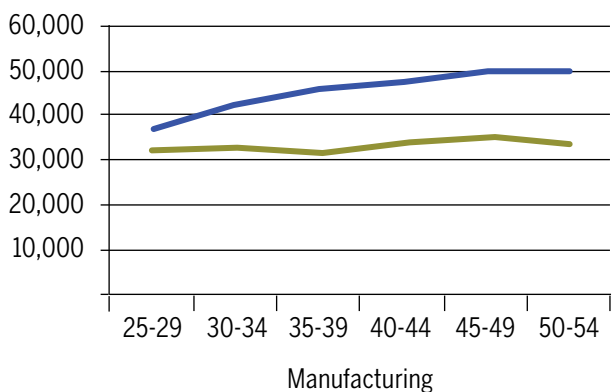
Law, Public Safety, Corrections, and Security

Examining Wages and Career Clusters

Figure 9, continued.

Wage differential by career cluster, age, and sex for full-time, full-year workers.

MALE
FEMALE



Four career clusters show average earnings for men that are at least \$25,000 more than those for women. These are Health Science (\$69,000), Finance (\$55,000), Business, Management, and Administration (\$42,000), and Marketing, Sales, and Service (\$25,000).

Disaggregating by career cluster and age reveals occupational bias in the gender wage gap.

Women older than 35 earn slightly more than 60 percent of what men of the same age earn. These differentials are positively related to educational attainment and occupational choice. The average differential between the earnings of men and women vary by age and career cluster. The gender wage gap is largest in Health Science; Finance; and Business, Management, and Administration.

This is true even when the data control for the duration of employment. When the data are restricted to full-time, full-year workers, the downward bias is diminished due to lower part-time wages. Women are more likely to work part-time, especially women with children.

High-Demand Versus High-Wage Jobs

One purpose of Perkins IV was to develop the academic and technical skills of secondary and postsecondary education students by developing challenging academic and technical standards. CTE programs have been challenged to use these standards to prepare students for high-skill, high-wage, or high-demand occupations in current or emerging professions.

Although the terms high-skill, high-wage, and high-demand appear throughout Perkins IV, the legislation offers no specific definition for them. These standards have been left to each state to define, and as such a variety of standards has emerged.

The Occupational Supply Demand System (OSDS) has collected definitions for 14 states. For example, the Illinois Department of Employment Security (IDES), the Illinois Workforce Investment Board (IWIB), and other education partners developed definitions:

High-Demand Criterion: Occupations with a projected employment growth rate (percent change) above the average employment growth rate (percent change) for all occupations of 8.66 percent, 2008-2018, or having at least 100 average annual job openings.

High-Wage Criterion: Occupations paying more than the all-industry, all-ownership median wage for Illinois (\$16.57 per hour or \$34,475 annually statewide).

High-Skill Criterion: Occupations with education and training requirements for long-term, on-the-job training of 12 months or longer and/or combined experience and training; work experience in a related occupation; postsecondary vocational award training; an Associate's degree; a Bachelor's degree; work experience and a Bachelor's degree or better; a Master's degree; a Doctoral degree; and first professional degree.

SOURCE: Georgia Career Information Center, Georgia State University for the U. S. Department of Labor

Comparing the 16 career clusters against simple standards for job growth on a national level identifies the career clusters that meet high-skill, high-wage, or high-demand criteria:

- High Demand: Employment is projected to grow faster than the average rate (10%) for all occupations between 2008 and 2018.
- High Wage: The average annual wage is greater than the average annual wage for all occupations in 2009 (\$51,610, the average for prime-age workers aged 25 to 54).
- High Skill: The percentage of employees with postsecondary education is greater than the overall average (59%) for all occupations in 2008.

Six of the 10 high-skill career clusters meet the high-wage criterion, and 5 meet the high-demand criterion (table 34). Information Technology; Health Science; and Law, Public Safety, Corrections, and Security meet all three criteria. Two high-skill career clusters (Arts, A/V Technology, and Communications; and Government and Public Administration) do not meet either of the other criteria and fall just short on the high-wage criterion. Education and Training and Human Services meet both the high-demand and the high-skill criteria but do not meet the high-wage criterion. Although these career clusters do not meet the high-wage criterion, CTE program planners should not be precluded from developing programs for occupations popular with students because the occupations are care-giving in nature.

Table 34. Information Technology; Health Science; and Law, Public Safety, Corrections, and Security meet national criteria for high demand, high wages, and high skills.

	GROWTH RATE 2008-2018 (%)	YEARLY WAGES 2009 (\$)	POSTSECONDARY EDUCATION 2008 (%)	HIGH DEMAND	HIGH WAGES	HIGH SKILL
Career cluster						
Information Technology	23	71,000	93	X	X	X
Education and Training	14	46,000	91	X		X
STEM	9	74,000	89		X	X
Health Science	21	63,000	80	X	X	X
Finance	10	64,000	80		X	X
Law, Public Safety, Corrections, and Security	14	69,000	77	X	X	X
Arts, A/V Technology, and Communications	5	49,000	76			X
Business, Management, and Administration	6	64,000	74		X	X
Government and Public Administration	8	50,000	68			X
Human Services	19	42,000	65	X		X
Marketing, Sales, and Service	11	51,000	57	X		
Agriculture, Food, and Natural Resources	3	44,000	42			
Manufacturing	-1	41,000	38			
Hospitality and Tourism	12	29,000	37	X		
Transportation, Distribution, and Logistics	4	40,000	37			
Architecture and Construction	7	45,000	35			
TOTAL	10	51,600	59			

SOURCE: Center on Education and the Workforce forecasts of educational demand through 2018
X meets criteria for high demand, high wage, or high skill.

Science, Technology, Engineering and Mathematics (STEM); Finance; and Business, Management, and Administration high-skill clusters are high wage but not high demand. Program planners should nevertheless be aware of the financial implications that accompany paying for education in these fields. Business, Management, and Administration did not meet the high-demand criterion, probably because it is a large cluster in terms of employment.

A cluster that fails to meet the high-skill criterion also fails to meet the high-wage criterion. Two meet the high-demand criterion only: Marketing, Sales, and Service; and Hospitality and Tourism. Marketing, Sales, and Service falls just short of the high-wage and high-skill criteria, whereas Hospitality and Tourism falls considerably short of both.

Agriculture, Food, and Natural Resources; Manufacturing; Transportation, Distribution, and Logistics; and Architecture and Construction do not meet any criteria. The high-demand criterion, based on the growth rate, is somewhat limiting for Manufacturing; and Architecture and Construction because these fields are expected to have numerous job openings due to replacement demand. Employers in Manufacturing are expecting to hire workers with the greater technical and problem-solving skills needed to handle more advanced equipment and manufacturing processes. These highly skilled workers are expected to replace the lower-wage assembly workers that have been offshored.

Some states add the number of projected job openings to the high-demand criterion for two reasons. For Business, Management, and Administration; and Manufacturing, some occupations with large employment bases will not grow very rapidly but are still projected to have large numbers of job openings. Conversely, some occupations may have very rapid growth but few actual job openings. It is risky for both the colleges offering such programs and the students enrolled to invest in these occupations because of their small size.

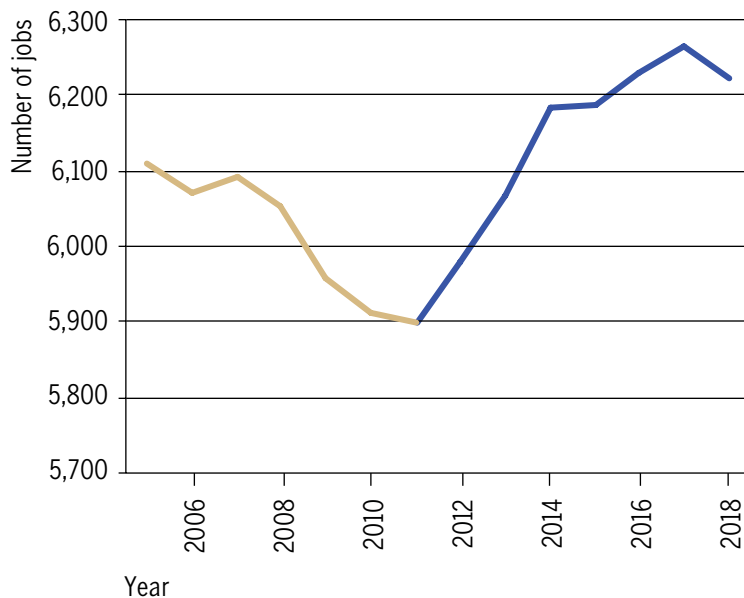
Forecasting Demand Cluster by Cluster Through 2018

In this section, we provide greater detail on the 16 career clusters, their education distribution, wage behavior, and demand prospects through 2018. Our intent is to provide policymakers, educators, state government officials, and all others with interest in specific clusters information on the growth prospects for the detailed occupations in each career cluster.

Career Cluster 1: Agriculture, Food, and Natural Resources

Agriculture, Food, and Natural Resources is expected to grow slowly through 2014 (1%) before leveling off and finally declining by 2018 (figure 10). By 2018, 44 percent of jobs will require at least some postsecondary education and training, up from 42 percent in 2008.

Figure 10. The national average for employment in Agriculture, Food, and Natural Resources is roughly 4 percent.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

This career cluster covers a range of professions: farmers and ranchers; geological and petroleum technicians; logging equipment operators; veterinarians; and more. Agricultural production and natural resource extraction have increased productivity and reduced manual labor costs by using more efficient equipment and making other technological advancements during the last 50 years. The United States has been a leader in implementing high-tech food production and using high-tech mining tools and systems. Incorporating new technology has been necessary to increase worker productivity.

Despite its productivity, Agriculture, Food, and Natural Resources has been shedding employment for decades. The national average for agriculture employment is roughly 4 percent and declining. Although agricultural output will grow, it will stem from greater productivity, not from expansion of the workforce.

FARMING AND FOOD PRODUCTION

Technological advancements have made the agriculture industry more efficient and productive while reducing labor demand. Employment for many positions in farming and food production is predicted to show little or no growth between 2008 and 2018 with a few exceptions. For example, farm consolidation will create a larger role for farm, ranch, and other agricultural managers, whose jobs are expected to grow by 6 percent. Increased efficiency will also play a role in reducing job prospects for the fishing industry. Jobs for fishers and related workers are expected to decline by 8 percent due to investments in automated equipment and fish-finding technologies. Jobs in food production, including fish cutters, meat and poultry trimmers, slaughterers, and meat packers, are expected to grow between 3 and 6 percent due to continued demand for processed and prepared foods.

Job growth is anticipated for veterinary medicine and related occupations. Although there will be some job growth in farm animal services, jobs for nonfarm animal caretakers, veterinarians, veterinary technologists, technicians, assistants, and laboratory animal caretakers are expected to increase by 20 percent because pet owners are more willing to pay for advanced veterinary services.

MINING OCCUPATIONS

Jobs in the mining industry continue to decline, largely due to improved automation and increased productivity. Highly advanced computerized systems have replaced many jobs previously filled by operators. Additionally, many mining jobs have also been lost to consolidation because mining operations more frequently employ contractors for

specialized work. For example, jobs for derrick and rotary drill operators are expected to decline by more than 20 percent between 2008 and 2018 because mining installations and heavy machinery are increasingly operated from a centralized control facility. Job opportunities for general extraction workers, such as roustabouts and helpers, are expected to decline between 10 and 20 percent due to decreased demand for nonspecialized workers. In contrast, jobs for cartographers and photogrammetrists are projected to increase by 27 percent between 2008 and 2018 as investment in oil and gas exploration grows.

FORESTRY AND LOGGING

Changing policy in forest fire prevention is predicted to open federal timberland for preventative forest thinning. Consequently, jobs for foresters and forest and conservation workers will grow by 7 to 13 percent. Increased funding for conservation will also contribute to growth. Job growth for forestry workers employed predominantly in urban areas, including tree trimmers and pruners, as well as other grounds maintenance workers, will be close to average. Job growth for forest and conservation technician workers is expected to be 9 percent to keep up with demands for urban forestry management and conservation.

Although favorable job prospects in the logging industry are expected, laborsaving equipment will severely limit job growth for manual laborers, including fallers, log graders and scalers, and sawing machine setters, operators, and tenders. Growth in the logging industry will continue to be limited by foreign competition.

NATURAL AND ENVIRONMENTAL SCIENTISTS AND RELATED WORKERS

Job growth for natural and environmental scientists and technicians will be significant. Career opportunities for animal scientists and food scientists and technologists are predicted to increase between 13 and 16 percent to meet demand for agricultural products that improve yields and comply with food safety and ecosystem health standards. Jobs for environmental engineers and environmental engineering technicians are expected to increase rapidly (more than 30%) in order to keep companies compliant with environmental regulations and to prevent future health hazards. Jobs for water and liquid waste treatment plant and system operators and refuse and recyclable material collectors are projected to grow by 20 and 19 percent, respectively. Job opportunities for these workers will be particularly good due to the high number of expected retirees through 2018.

Forecasting Demand Cluster by Cluster Through 2018

EDUCATION DISTRIBUTION OF AGRICULTURE, FOOD, AND NATURAL RESOURCES JOBS

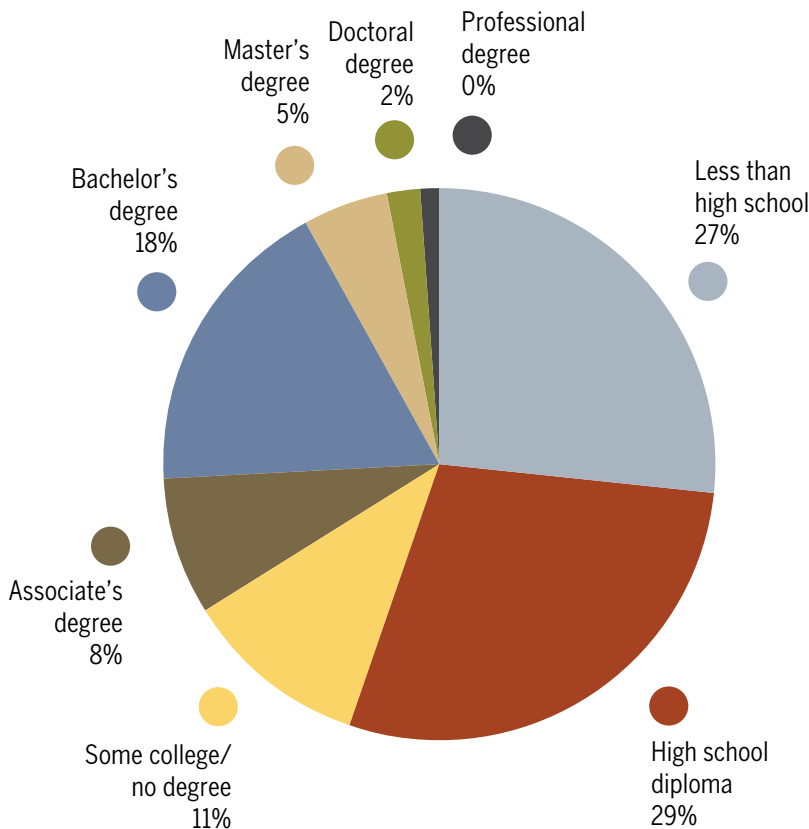
Between 2008 and 2018, the proportion of jobs requiring a Bachelor's degree will increase from 16 to 18 percent (table 35). A little less than one-half of jobs will require at least some postsecondary education and training by 2018 (figure 11). Five percent of jobs will require a Master's degree, and only 2 percent will require a doctoral degree by 2018. Although the career cluster is dominated by jobs requiring a high school diploma or less, the postsecondary middle-skills market will still make up 19 percent of jobs by 2018.

Table 35. The education level required for jobs in Agriculture, Food, and Natural Resources varies widely.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL	HIGH SCHOOL DIPLOMA	SOME COLLEGE/NO DEGREE ^a	ASSOCIATE'S DEGREE	BACHELOR'S DEGREE	MASTER'S DEGREE OR BETTER	
Career cluster							
Farm, ranch, and other agricultural managers	12	33	20	10	22	4	100
Farmers and ranchers	11	42	20	10	15	2	100
Veterinarians	0	1	0	.	1	97	100
First-line supervisors/managers of landscaping, lawn service, and groundskeeping workers	19	33	22	9	15	1	100
Pest control workers	10	43	30	6	9	1	100
Nonfarm animal caretakers	10	38	27	8	14	2	100
Agricultural equipment operators	59	26	8	3	4	1	100
Roustabouts, oil and gas	16	55	21	4	3	0	100
Butchers and meat cutters	39	41	14	4	2	0	100
Food batchmakers	24	47	18	5	5	1	100
Water and liquid waste treatment plant and system operators	4	45	32	11	8	1	100
Refuse and recyclable material collectors	29	47	15	4	3	1	100
Surveyors, cartographers, and photogrammetrists	0	1	12	10	62	14	100
Conservation scientists and foresters	1	1	7	9	63	21	100

^a Some college includes postsecondary vocational certificates.

Figure 11. About one-half of all jobs in Agriculture, Food, and Natural Resources will require postsecondary education and training by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Mining workers and many farm and food workers require training and experience due to the use of complex equipment and the health and safety risks posed by these jobs. In both the mining and farming industries, one-, two- and four-year postsecondary programs prepare workers to use the latest technology. Many workers are licensed: cartographers and photogrammetrists with a Bachelor's degree must also be licensed in their state. Training programs for foresters and loggers include environmental compliance and business management; many of these programs lead to licensing and certification. Water and liquid waste treatment plant and system operators require little more than a high school diploma, although all must be certified by their state.

Forecasting Demand Cluster by Cluster Through 2018

Similar to education and training requirements, average salaries for occupations in Agriculture, Food, and Natural Resources varying widely (table 36). Highly trained workers (farm, ranch, and other agricultural managers) tend to earn more than the staff they manage.

Table 36. Several jobs in Agriculture, Food, and Natural Resources pay wages above the MET at all levels of educational attainment.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Farm, ranch, and other agricultural managers	40,900	45,200	49,600	44,300	59,900	74,900
Farmers and ranchers	21,900	26,600	30,000	29,900	32,900	30,400
Veterinarians	—	—	—	—	69,700	73,700
First-line supervisors/managers of landscaping, lawn service, and groundskeeping workers	24,700	29,700	33,300	37,300	41,700	—
Pest control workers	27,800	33,200	35,200	31,700	33,900	—
Nonfarm animal caretakers	17,500	14,800	15,400	16,500	20,800	19,500
Agricultural equipment operators	17,800	22,700	24,400	25,900	26,100	—
Roustabouts, oil and gas	42,900	52,900	57,200	58,800	57,100	—
Butchers and meat cutters	22,900	30,100	33,400	33,100	27,300	—
Food batchmakers	21,600	26,400	25,900	24,300	24,900	—
Water and liquid waste treatment plant and system operators	39,400	42,100	47,300	47,100	51,000	—
Refuse and recyclable material collectors	21,100	29,200	34,100	35,600	31,300	—
Surveyors, cartographers, and photogrammetrists	34,100	38,800	44,800	49,400	50,000	53,700
Conservation scientists and foresters	62,500	51,800	43,000	46,100	51,000	53,800

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

Farm, ranch, and other agricultural managers with a Bachelor's degree make more than \$14,000 more than their counterparts with only a high school diploma. At all levels of educational attainment, farm, ranch, and other agricultural managers work in jobs that pay more than the MET, but the average farmer/rancher earns wages below the MET.

Veterinarians earn an average salary of \$74,000 or slightly more than double the MET. In a related field, most nonfarm animal caretakers, who tend to have limited postsecondary education, make only one-half the MET.

Workers in Agriculture, Food, and Natural Resources with only a high school diploma can earn relatively high wages. Nearly one-half of water and liquid waste treatment plant and system operators with a high school diploma earn an average of \$42,000, slightly more than the MET.

Work that requires higher education, however, does make a difference in salary. Conservation scientists and foresters; and surveyors, cartographers, and photogrammetrists with at least a Bachelor's degree earn \$50,000 or more.

Career Cluster 2: Architecture and Construction

Architecture and Construction comprises about 7 percent of jobs in the United States and is projected to grow by 7 percent through 2018. Overall, 34 percent of jobs will require at least some postsecondary education and training by 2018 (table 37).

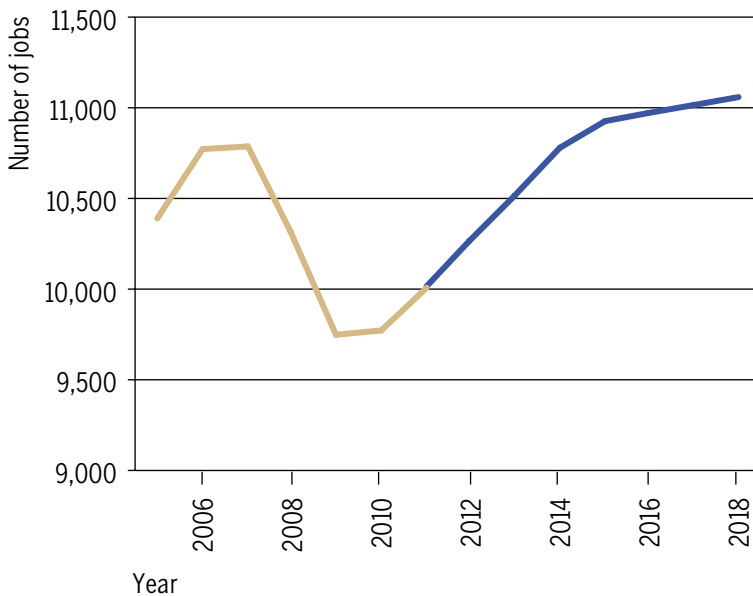
The recession of 2007 hit jobs in this career cluster very hard: almost 10 percent of jobs were lost between 2007 and 2008 (figure 12). Architecture and Construction is not projected to resume employment levels like those of 2007 until 2014 and will not exceed 2007 levels until 2015.

Table 37. Many jobs in Architecture and Construction require a high school diploma or middle skills.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	TOTAL (%)
Construction managers	8	31	25	8	24	5	100
Cost estimators	3	25	29	12	28	3	100
Architects, except landscape and naval	0	2	4	5	53	36	100
Civil engineers	0	3	6	6	59	26	100
Landscaping and groundskeeping workers	42	34	14	4	5	1	100
First-line supervisors/managers of construction trades and extraction workers	15	44	24	7	8	1	100
Carpenters	25	44	19	5	5	1	100
Cement masons and concrete finishers	43	41	12	2	2	0	100
Construction laborers	36	40	15	4	4	1	100
Operating engineers and other construction equipment operators	23	53	17	4	2	0	100
Drywall and ceiling tile installers	47	39	11	2	2	0	100
Electricians	9	40	31	13	6	1	100
Painters, construction and maintenance	34	40	15	4	6	1	100
Plumbers, pipefitters, and steamfitters	19	47	23	6	4	1	100
Roofers	48	37	10	2	2	1	100
Sheet metal workers	16	48	24	8	3	1	100
Highway maintenance workers	15	57	20	5	3	0	100
Heating, air conditioning, and refrigeration mechanics and installers	13	43	28	12	4	1	100
Helpers—installation, maintenance, and repair workers	35	41	15	4	4	1	100
Installation, maintenance, and repair workers, all other	17	40	25	9	7	1	100

^a Some college includes postsecondary vocational certificates.

Figure 12. Almost 10 percent of jobs in Architecture and Construction were lost between 2007 and 2008.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

As the recession ends, however, the aging population (50- and 60-year-old empty nesters), later-marrying adults, and the echo boomers (children born between 1982 and 1995) will move to metropolitan areas. This geographic shift will increase demand for buildings, products, and services.

PLANNING, DESIGN, AND INSPECTION

Jobs for architects, except landscape and naval architects, will increase 16 percent between 2008 and 2018; job growth for landscape architects is estimated at 20 percent. Whereas above-average growth is expected for these architects due to increased demand for new construction projects from a growing population, job growth for landscape architects will be exceptional due to the growing green-building industry. Job opportunities for mechanical drafters will decline 1 percent because the efficiency of design software limits the need for new workers. Additionally, career growth for mechanical drafters is aligned with the manufacturing industry, which is expected to grow slowly between 2008 and 2018.

Employment for cost estimators is expected to increase 25 percent for many of the reasons that apply to architects. More workers in these and related fields will be needed to keep up with the growing complexity of

new projects in the construction industry. Similarly, career opportunities for civil engineers are expected to grow by 24 percent to address national infrastructure needs.

Jobs for construction and building inspectors are projected to increase by 17 percent. New architectural software provides a readily available source of information for inspectors, increasing their ability to ensure that new projects pass state and local building codes. Career growth for construction and building inspectors is linked to public concern for safety, especially in areas prone to natural disasters.

PRODUCTION

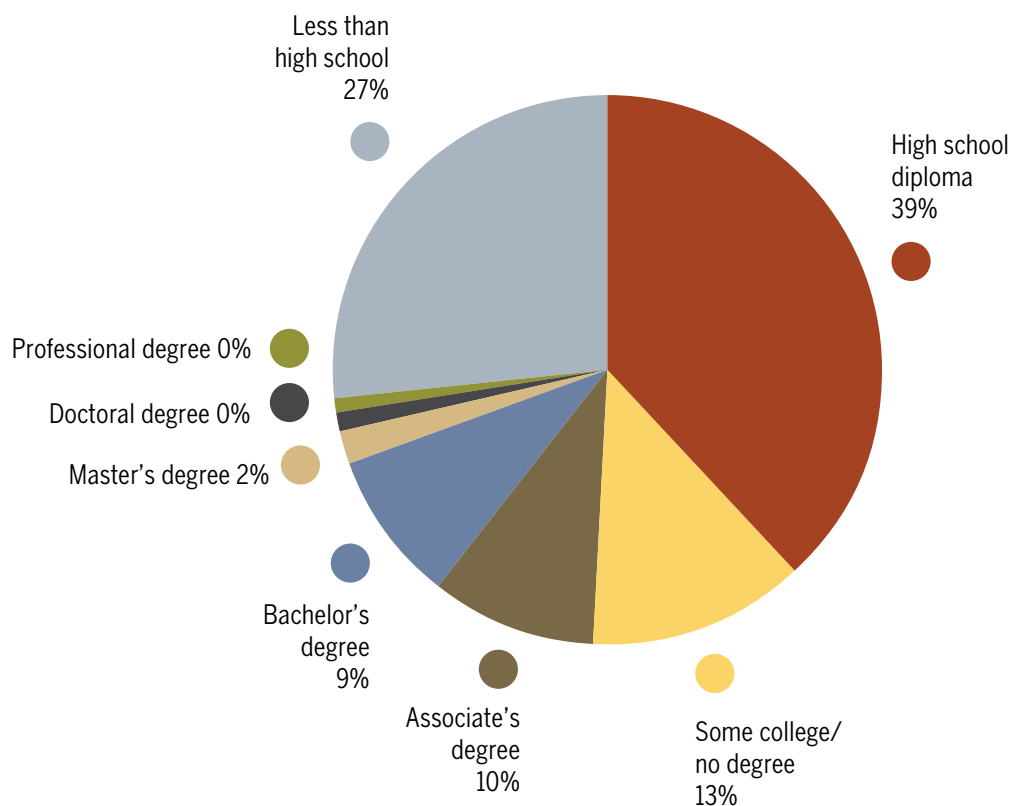
Growth in the construction industry is tied to the health of the economy and population trends. Many production workers will be needed to keep up with projected demand for new construction between 2008 and 2018. For example, jobs for construction managers are expected to see 17 percent growth due to the increasing volume, variety, and complexity of the industry. Jobs for construction laborers are projected to increase 20 percent due to demand from a growing population and an increase in public infrastructure projects. Job growth for landscaping and groundskeeping workers, another large job category, is projected at 18 percent due to demand from large institutions looking for a competitive edge through well-manicured grounds and homeowners wishing to reduce time-consuming household chores.

Similarly, jobs for construction and maintenance painters are expected to increase 7 percent, mainly due to projected public funding for projects that reduce deterioration in expensive infrastructure such as bridges. Carpenters will likewise be employed by the public and private sectors in new-home production, home remodeling, and larger scale public projects. Career opportunities for carpenters are expected to grow 13 percent.

Job growth is more varied for other specialty workers. Jobs for heating, air conditioning, and refrigeration mechanics and installers are expected to grow by 28 percent due to increased demand to install and replace units while keeping up with the growing construction industry. Jobs for conveyor operators and tenders; hoist and winch operators; and crane and tower operators are projected to decline sharply by 9, 8, and 7 percent, respectively, due to increased automation and other productivity measures that will limit job growth in these and related fields. Similarly, jobs for structural metal fabricators and fitters will not grow between 2008 and 2018.

Between 2008 and 2018, the proportion of jobs requiring a Bachelor's degree will increase from 7 to 9 percent. Two percent will require a Master's degree by 2018; overall, 34 percent will require at least some postsecondary education and training by 2018 (figure 13). Although workers with a high school diploma or less dominate the career cluster, the postsecondary middle-skills market will still make up 23 percent by 2018. Still, there is great stratification within this career cluster: architecture jobs will require 97 percent of workers to have at least some postsecondary education and training by 2018, compared to 30 percent of construction jobs.

Figure 13. A little more than one-third of jobs in Architecture and Construction will require postsecondary education and training by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Whereas some careers in Architecture and Construction require advanced degrees and competitive licensure, many jobs are available for workers willing to gain necessary skills through apprenticeships and on-the-job training. Many architects earn a professional degree, work for years under supervision, and commit to continuing education in order to meet state licensing rules. Some architects even seek board certifications from organizations like the National Council of Architectural Registration Boards (NCARB) to assist them with the process of becoming licensed and more readily gaining interstate reciprocity. Almost one-third of architects held the NCARB certification in 2009. Similarly, civil engineers must be licensed to provide direct services to the public. Civil engineers typically work as apprentices for four years before taking the state licensing examinations. Although some states require construction and building inspectors to be licensed, a combination of experience and coursework may suffice for many.

Most production workers (e.g., construction laborers, carpenters, and crane and tower operators) prepare for their careers through on-the-job training. Postsecondary education is becoming much more necessary, however, with the integration of technology into some jobs (e.g., heating, air conditioning, and refrigeration mechanics and installers). Furthermore, construction managers are increasingly supplementing their years of industry experience with an Associate's degree or a Bachelor's degree in related subjects to increase their job prospects.

Workers who seek postsecondary education are rewarded not only with more opportunities for moving up within the industry, but also with higher salaries within their occupations (table 38). Construction managers with a high school diploma make \$31,000 less a year, on average, than their counterparts with a Bachelor's degree. Similarly, carpenters with at least some college/no degree (19%) make almost \$5,000 more than those with less than high school (25%).

Table 38. Within Architecture and Construction, increased educational attainment results in higher earnings and increases one's likelihood of earning wages above the MET.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Construction managers	38,300	49,500	57,100	58,500	80,900	91,100
Cost estimators	63,200	56,800	59,500	61,800	72,000	89,200
Architects, except landscape and naval	—	—	56,100	51,700	67,200	72,100
Civil engineers	—	59,900	63,200	61,100	78,000	89,200
Landscaping and groundskeeping workers	16,400	19,000	19,900	22,000	22,200	—
First-line supervisors/managers of construction trades and extraction workers	40,500	48,400	52,200	54,800	63,700	—
Carpenters	23,500	27,600	28,300	28,700	26,600	—
Cement masons and concrete finishers	26,700	31,200	28,400	—	—	—
Construction laborers	22,800	28,300	28,800	29,200	31,500	—
Operating engineers and other construction equipment operators	35,400	41,700	43,900	—	47,200	—
Drywall and ceiling tile installers	22,500	26,000	25,800	—	—	—
Electricians	33,000	42,500	46,800	51,200	46,000	—
Painters, construction and maintenance	20,000	22,500	22,400	21,500	20,700	—
Plumbers, pipefitters, and steamfitters	30,400	41,000	45,100	47,600	43,700	—
Roofers	22,300	25,200	27,600	—	—	—
Sheet metal workers	29,600	40,000	42,600	43,200	38,300	—
Highway maintenance workers	30,000	36,000	37,000	39,400	47,200	—
Heating, air conditioning, and refrigeration mechanics and installers	32,100	38,200	41,400	43,600	44,200	—
Helpers—installation, maintenance, and repair workers	22,700	24,300	27,900	31,200	22,200	—
Installation, maintenance, and repair workers, all other	25,300	34,500	36,500	40,500	40,400	—

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

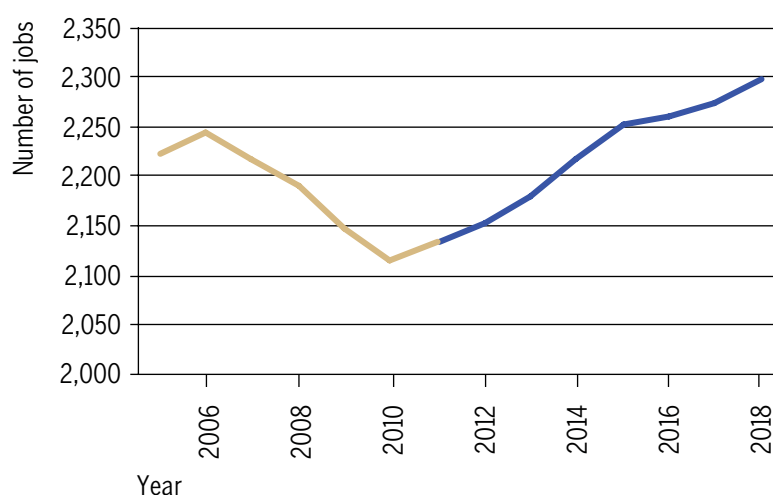
Forecasting Demand Cluster by Cluster Through 2018

¹⁷ Artists and performers have particular gifts and unique skills that may be developed by specialized training, but this training is different from many other occupational areas. Art and performance are highly competitive fields in which many workers have degrees in other fields; participation is an avocation for most of them.

Career Cluster 3: Arts, A/V Technology, and Communications

Arts, A/V Technology, and Communications is projected to grow by 15 percent between 2008 and 2018 (figure 14). Jobs in this career cluster are highly concentrated in postsecondary education: fully 79 percent will require some postsecondary education by 2018 (table 39).¹⁷

Figure 14. Jobs in Arts, A/V Technology, and Communications are expected to grow by 15 percent between 2008 and 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 39. Many jobs in Arts, A/V Technology, and Communications require a Bachelor's degree.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	TOTAL (%)
Multimedia artists and animators	3	11	19	11	45	12	100
Commercial and industrial designers	2	12	18	14	46	8	100
Actors	3	11	21	7	47	11	100
Producers and directors	1	6	14	6	58	14	100
Music directors and composers	5	15	24	5	32	20	100
Entertainers and performers, sports and related workers, all other	7	21	28	9	28	7	100
Radio and television announcers	5	21	28	8	32	5	100
Reporters and correspondents	0	2	9	4	65	20	100
Editors	1	4	11	4	58	23	100
Writers and authors	0	3	9	3	55	30	100
Media and communication workers, all other	3	12	22	15	32	17	100
Audio and video equipment technicians	2	19	29	15	31	4	100
Photographers	2	15	24	12	41	6	100
Telecommunications line installers and repairers	6	39	34	13	8	1	100
Bindery workers	19	50	20	4	6	2	100
Job printers	13	49	25	5	7	1	100
Prepress technicians and workers	7	35	26	13	16	2	100
Printing machine operators	13	51	23	7	6	0	100

^a Some college includes postsecondary vocational certificates.

Jobs in Arts, A/V Technology, and Communications generally align with the business cycle because discretionary spending on entertainment and leisure activities tends to dry up during a recession, as it did between 2007 and 2009. Many theatres, museums, and cultural institutions are cutting expenses with salary freezes or layoffs in response to a decline in donations from businesses, individuals, and governments. As the recession recedes, however, growth will slowly pick up. It is anticipated that New York City and Los Angeles will continue to be the primary U.S. cities for job opportunities.

Occupations in Arts, A/V Technology, and Communications consist of artists, technicians and operators, and administrative support workers. Artists include workers in the fine arts; craft and multimedia artists; designers; photographers; writers and authors; editors; musicians; composers; and others in the entertainment and news business. Technicians and operators work behind the scenes. Administrative support workers include desktop publishers, bindery workers, bookbinders, and job printers.

MULTIMEDIA ARTISTS, WRITERS, AND ANIMATORS

Technological advances and lower prices for high-tech equipment are expected to affect the demand for professionals in this career cluster. Three occupations will dominate growth in the coming decade: multimedia artists and animators; writers and authors; and theatrical and performance makeup artists. The number of jobs for multimedia artists and animators is expected to increase by 14 percent.

Jobs for writers and authors are expected to increase 15 percent because technology has opened more doors for these workers. With new media, such as blogs, and the growing use of e-readers and hand-held devices, writers and authors can work almost anywhere in the world, thus changing the nature of media jobs to one that requires more computing skills. Freelance writers, however, are expected to see only moderate job growth.

CRAFT ARTISTS AND FINE ARTISTS

Job opportunities for artists and related workers are expected to grow by 12 percent. By profession, job growth is expected as follows: craft artists (7%); fine artists such as painters, sculptors, and illustrators (9%); all other artists and related workers (8%); commercial and industrial designers (9%); and graphic designers (13%).

Job growth for graphic designers derives from the demand for websites and the growing use of mobile devices. Graphic designers with experience in animation and interactive media will be in high demand. However, as websites and mobile devices become more popular, their use will replace some of the demand previously found for graphic artists in print publishing.

ARTISTS IN THE ENTERTAINMENT INDUSTRY

Jobs for actors are expected to grow by 13 percent; producers and directors, by 10 percent; music directors and composers, by 10 percent; musicians and singers, by 8 percent; public address system and other announcers, by 8 percent; and photographers, by 12 percent. Multimedia technology is expected to curtail some of this growth. For example, jobs for many stunt actors will succumb to more advanced animation technology, which often replaces live actors. Slow growth is predicted for dancers (7%) and choreographers (5%).

NEWS OCCUPATIONS

Jobs for radio and television announcers; and reporters and correspondents will experience greater decline in coming years as traditional media continues to adjust and restructure in response to the Internet and social media. Moreover, there is little or no growth expected for editors as the newspaper industry consolidates.

TECHNICIANS AND OPERATORS

Technician and operator jobs are projected to show some growth between now and 2018. More noncommercial recording and editing products will lead to limited job growth for some technical support and operator positions. This is especially true for printing machine operators (5% decline), broadcast technicians (2% growth), and sound engineering technicians (6% growth). Growing consumption of video communication over the Internet, especially with the expansion of electronic news media, will keep job prospects for film and video editors (12%) and camera operators for television, video, and motion pictures (9%) close to the national average. Jobs for audio and video equipment technicians will grow by 13 percent due to demand for installing, maintaining, and repairing the latest equipment in offices, schools, and some businesses; whereas jobs for telecommunications line installers will grow by only 1 percent.

ADMINISTRATIVE SUPPORT

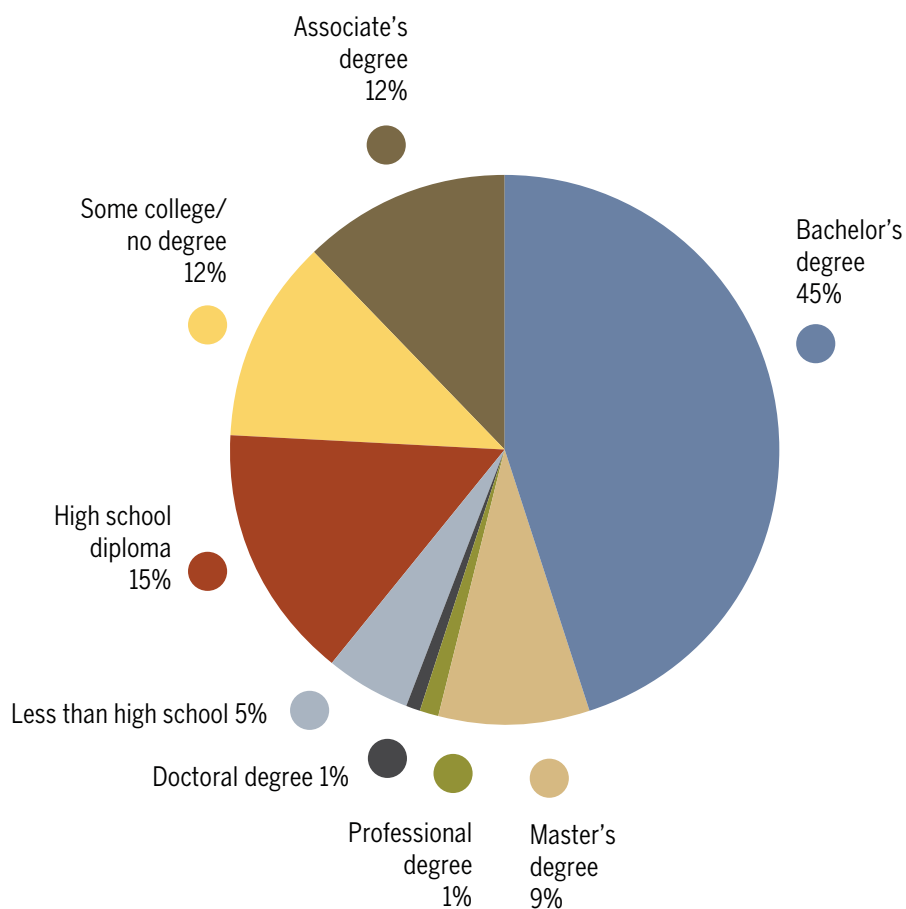
Administrative support jobs for this career cluster include desktop publishers, bindery workers, bookbinders, and job printers. These occupations are in decline as technological advances make it possible

for one person to do work that would previously have been done by several people. Overall, jobs in print media are expected to decline due to the increase in e-publishing and online readership. Jobs for desktop publishers are projected to decline by 23 percent between 2008 and 2018, for bindery workers, by 20 percent; bookbinders, by 12 percent; and job printers by 3 to 9 percent.

EDUCATION DISTRIBUTION OF ARTS, A/V TECHNOLOGY, AND COMMUNICATIONS JOBS

Between 2008 and 2018, the proportion of jobs requiring a Bachelor's degree will increase from 40 to 45 percent. By 2018, however, fully 79 percent of jobs will require some form of postsecondary education by 2018 (figure 15). The postsecondary middle-skills job market will make up almost a quarter of jobs by 2018.

Figure 15. Almost 80 percent of jobs in Arts, A/V Technology, and Communications will require postsecondary education by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

This career cluster represents a highly educated slice of the workforce, with more than one-half of its workers obtaining at least a Bachelor's degree to stay competitive in their field and earn competitive salaries (table 40). Most editors, writers, and authors with at least a Bachelor's degree earn close to \$14,000 more, on average, than their colleagues with only some college and no formal degree. Most telecommunications line installers and repairers gain technical skills through on-the-job training and postsecondary education. Adding years of formal education pays off for these jobs: workers with at least some college/no degree make nearly \$20,000 more than workers with a high school diploma or less.

Table 40. Attaining a high school diploma translates into wages above the MET for actors, telecommunications line installers and repairers, job printers, and printing machine operators.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Multimedia artists and animators	20,000	19,300	28,600	36,800	39,700	32,700
Commercial and industrial designers	—	32,600	37,400	40,200	44,600	54,500
Actors	31,900	35,900	36,700	33,000	39,200	55,700
Producers and directors	—	50,600	57,400	48,600	65,000	75,200
Music directors and composers	15,700	21,700	22,300	18,900	25,700	34,100
Entertainers and performers, sports and related workers, all other	19,800	22,600	26,500	32,600	28,700	37,600
Radio and television announcers	32,100	34,500	39,000	38,700	57,000	50,000
Reporters and correspondents	—	33,300	42,200	39,700	56,700	63,400
Editors	—	40,200	39,900	45,100	53,600	50,400
Writers and authors	33,600	29,000	37,000	30,500	45,500	42,400
Media and communication workers, all other	24,200	27,700	24,600	26,400	28,500	32,500
Audio and video equipment technicians	—	38,400	42,500	45,200	48,400	56,400
Photographers	—	23,800	24,400	25,200	28,700	27,300
Telecommunications line installers and repairers	32,200 24,700	45,700 30,400	52,000 32,800	52,000 31,800	51,300 27,800	— —
Bindery workers						
Job printers	26,700	35,600	36,700	34,600	35,600	—
Prepress technicians and workers	27,700	32,900	36,000	33,700	34,800	—
Printing machine operators	30,400	37,700	37,600	38,000	35,400	—

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

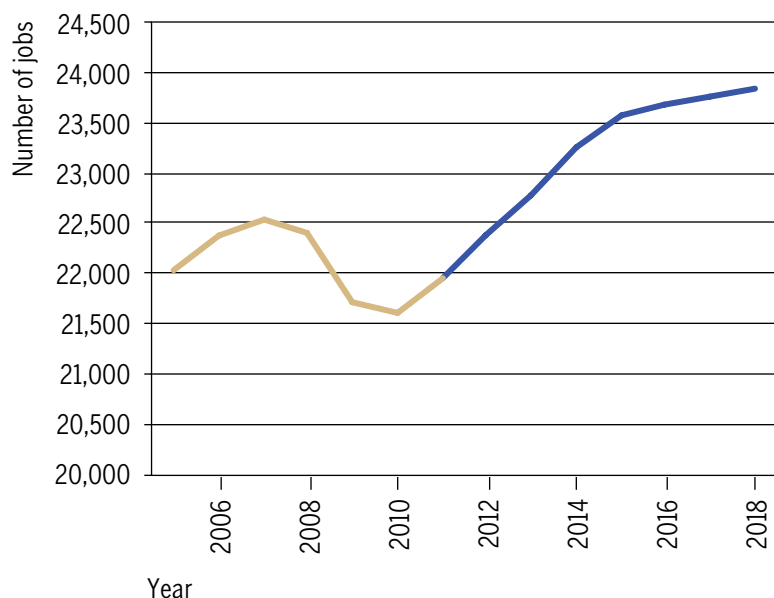
More than one-half of multimedia artists and animators have either an Associate's or a Bachelor's degree. Printing machine operators with a high school diploma (87%) boost their wages over the MET.

Job printers and bindery workers are two occupations expected to decline between 2008 and 2018. Whereas salaries for job printers hover around the MET except for those with a high school diploma or less, average wages for bindery workers are below the MET regardless of education level.

Career Cluster 4: Business, Management, and Administration

Occupations in Business, Management, and Administration are projected to grow by 6 percent between 2008 and 2018; this translates to a steady 2 percent growth through 2014 and slower growth through 2018 (figure 16).¹⁸ By 2018, 80 percent of jobs will require at least some postsecondary education (table 41). Although the greatest number of jobs go to workers with a Bachelor's degree, the postsecondary middle-skills market is significant.

Figure 16. Jobs in Business, Management, and Administration are projected to grow by 6 percent between 2008 and 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

¹⁸ The information for this career cluster must be combined with Finance and Marketing, Sales, and Service. Even when taken together, the three clusters have a number of nonoverlapping jobs that lead to divergent training requirements. Other than personal finance and the stock market, high school students have limited exposure Business, Management, and Administration; Marketing, Sales, and Service; and Finance. At the postsecondary level, programs are much more specialized: the marketable credential is often a Bachelor's degree.

Table 41. Many jobs in Business, Management, and Administration require a Bachelor's degree.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
CEOs	2	12	17	6	41	23	100
General and operations managers	2	17	24	8	35	13	100
Sales managers	1	8	16	7	49	18	100
Industrial production managers	1	12	19	8	42	19	100
Medical and health services managers	1	10	16	14	32	27	100
Managers, all other	3	15	20	8	36	19	100
Management analysts	1	5	12	5	44	33	100
Business operation specialists, all other	2	15	22	11	35	15	100
Accountants and auditors	0	4	8	10	58	20	100
First-line supervisors/managers of office and administrative support workers	3	25	31	12	23	6	100
Bookkeeping, accounting, and auditing clerks	3	31	40	11	14	2	100
Receptionists and information clerks	5	37	34	11	11	2	100
Stock clerks and order fillers	16	46	24	6	7	1	100
Executive secretaries and administrative assistants	2	31	35	14	15	2	100
Data entry keyers	3	32	35	13	15	2	100
Office and administrative support workers, all other	3	23	30	12	25	7	100

^a Some college includes postsecondary vocational certificates.

Business, Management, and Administration has evolved into a complex accumulation of jobs that include planning, organizing, directing, and monitoring decision making to increase efficiency and productivity. This career cluster encompasses a range of occupations including managers and executives; specialists; analysts and technical experts; and support staff. As a result, this cluster employs people with a wide variety of educational backgrounds.

The deepest decline took place in 2009 at the height of job losses during the recession. Between 2008 and 2009, jobs fell by 3 percent from 22.4 to 21.7 million.

MANAGERS AND EXECUTIVES

Between 2008 and 2018, job growth for managers is expected to fluctuate due to the slow economic recovery and industry consolidation. The fate of individual industries will affect managers and executives within those industries, especially CEOs and general and operations managers, for whom there will be little or no job growth between 2008 and 2018.

Managers and executives in the medical and technology industries will see rising job prospects. Jobs for medical and health services managers are expected to grow by 16 percent due to increased demand resulting from changes in healthcare regulation, new medical technology, and more emphasis on preventative care. More managers will be needed to staff new clinics and other outpatient-care sites.

New technological applications have created demand for more computer and information system managers. Jobs for these workers are expected to increase 17 percent through 2018. In the finance industry, however, job growth is highly dependent on mergers and acquisitions and corporate downsizing. Jobs for financial managers are expected to grow more slowly (8%).

Administrative managers employed by management service and consulting firms are affected by improvements in office technology. Jobs for administrative managers are expected to grow by 12 percent because these workers are less likely to be affected by economic downturns. Jobs for managers in marketing (12%), sales (15%), and public relations (13%) are expected to grow by close to 10 percent, the average national growth rate between 2008 and 2018.

SPECIALISTS, ANALYSTS, AND TECHNICAL EXPERTS

Excellent job prospects are projected for specialists, analysts, and technical experts who support managers and executives. Jobs for accountants and auditors are expected to grow by 22 percent by 2018; more of these workers will be needed to provide services to new businesses. Economic growth will be responsible for some of this growth, but the drivers will be regulatory change, new information technology, and e-commerce. The increasing complexity of the field due to changing financial laws and regulations, international trade and global acquisitions, and a greater emphasis on financial transparency and accountability will generate additional demand for these jobs.

Jobs for management analysts are expected to grow by 24 percent between 2008 and 2018. Demand for these workers is driven by the public and private sector's desire to improve performance. For example, new companies might hire management analysts for advice on website design, pricing strategies, marketing, inventory, and human resource management. By contrast, large consulting firms are expected to draw on international experience. Job growth is expected in biotechnology, healthcare, information technology, human resources, engineering, and marketing. In the private sector, management analysts often help the company reduce costs, simplify operations, and develop marketing strategies. In the public sector, these analysts will be needed to improve efficiency.

Jobs for compensation, benefits, and job analysis specialists are projected to grow by 24 percent. Demand for training and development specialists is expected to grow by 23 percent due to a renewed focus on specialized training and worker retention.

Jobs for human resource specialists are expected to grow rapidly between 2008 and 2018. Additional experts in human resources, training, and labor relations will be needed to help companies comply with legislation and court rulings that have revised many company policies, including those related to hiring and benefits. The number of jobs for employment, recruitment, and placement specialists is expected to grow by 20 percent. Large turnover and retirement rates are expected in these occupations during the next few years and will, in turn, increase medium-term openings. However, the increase in online employment and placement agencies and job posting websites is likely to temper growth in this area in the long term. Whereas average growth for human resource managers is expected to keep up with high demand for this area of expertise, jobs for assistants of human resource specialists are projected to decline sharply due to automation and other efficiency measures.

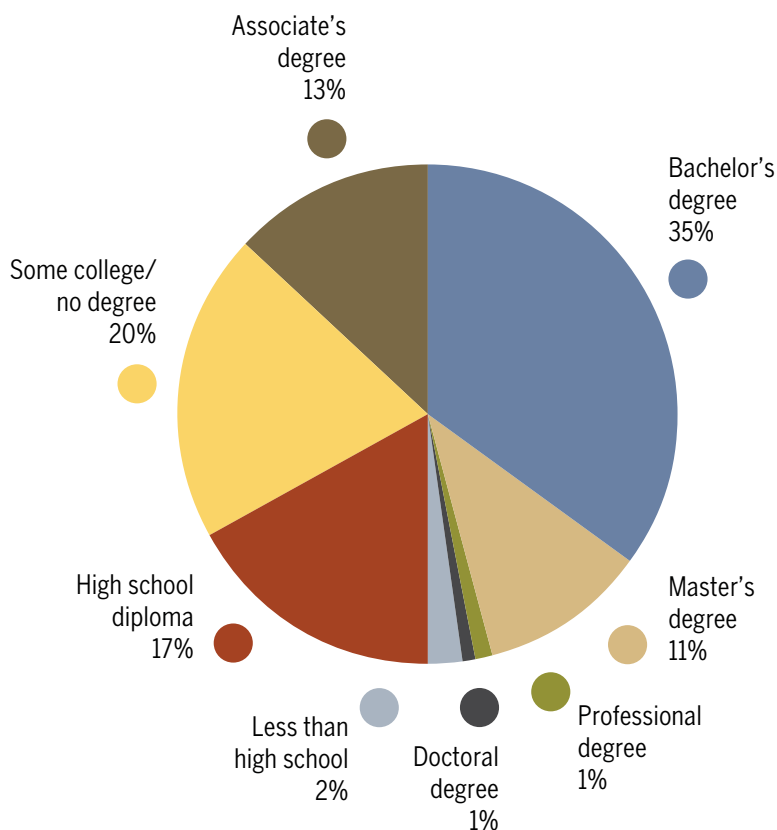
SUPPORT STAFF

Technology and office automation that increase efficiency will lead to declines for many support and general staff jobs. Jobs easily automated, such as those for file clerks (-23%); computer operators (-19%); and word processors and typists (-6%), are projected to decline rapidly; whereas routine jobs not easily automated, such as those for stock clerks and order fillers, are projected to have close to average growth (7%). Secretaries, receptionists, and clerks in growing industries will still be needed: career opportunities for medical and legal secretaries are expected to outperform the national average of 10 percent; jobs for receptionists and information clerks in medical and health offices are expected to grow by 15 percent. Jobs for secretaries in other industries, however, will see growth below the national average. The decline in employment for support staff will limit opportunities; however, high job turnover will continually provide openings for job seekers.

EDUCATION DISTRIBUTION OF BUSINESS, MANAGEMENT, AND ADMINISTRATION JOBS

Between 2008 and 2018, the share of jobs requiring a Bachelor's degree will increase from 30 to 35 percent. However, 80 percent of jobs will require at least some postsecondary education and training (figure 17). Eleven percent of jobs will require a Master's degree and only 1 percent will require a doctorate by 2018. Although workers with a Bachelor's degree or better hold most management positions, roughly one-third of management positions will be in the postsecondary middle-skills job market by 2018.

Figure 17. More than one-third of jobs in Business, Management, and Administration will require a Bachelor's degree or better by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Managers, executives, specialists, analysts, and technical experts have a wide range of educational backgrounds. Many workers in business management obtain certificates and attend specialized trainings. A variety of certification programs help distinguish candidates, such as the Certified Manager credential offered by the Institute of Certified Professional Managers; the Examination for Accreditation in Public Relations; and the Certified Public Accountant (CPA) credential. CPA credentials are particularly difficult to obtain: candidates must have at least a Bachelor's degree, a current certification or license (a requirement that varies by state), as well as significant work experience in public accountancy.

Support staff positions in Business, Management, and Administration are typically entry-level and require little preparation beyond on-the-job training and basic computer skills. For example, more than one-third of receptionists and information clerks hold a high school diploma or

less, and the average receptionist or information clerk with a high school diploma earn slightly more than \$23,000 (table 42). Similarly, executive secretaries and administrative assistants with the same education make \$6,000 more (\$30,000). A Bachelor's degree translates to a salary boost of \$2,500 for receptionists and information clerks and \$3,500 for executive secretaries and administrative assistants.

Table 42. Within Business, Management, and Administration, increased educational attainment almost always pays off.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
CEOs	79,800	91,800	112,800	103,100	154,700	179,100
General and operations managers	57,000	61,500	68,700	71,000	96,100	125,400
Sales managers	52,500	60,900	70,800	67,400	97,300	120,100
Industrial production managers	53,500	52,600	58,300	56,800	93,200	143,500
Medical and health services managers	38,100	43,300	51,500	59,400	72,000	97,100
Managers, all other	38,800	51,400	60,500	60,100	88,500	115,000
Management analysts	48,500	49,500	56,800	56,000	77,300	97,000
Business operation specialists, all other	34,500	40,300	44,200	48,000	57,900	77,300
Accountants and auditors	48,100	39,500	42,200	40,500	66,300	86,900
First-line supervisors/managers of office and administrative support workers	35,700	39,900	43,200	44,500	57,100	76,200
Bookkeeping, accounting, and auditing clerks	26,700	31,000	32,700	30,200	32,800	42,600
Receptionists and information clerks	21,000	23,400	23,900	24,000	25,900	30,400
Stock clerks and order fillers	20,700	24,800	26,400	27,700	28,700	37,000
Executive secretaries and administrative assistants	24,900	29,800	31,300	31,800	33,500	35,500
Data entry keyers	25,400	27,900	27,700	28,200	30,100	34,700
Office and administrative support workers, all other	29,000	33,700	35,800	36,100	43,600	58,800

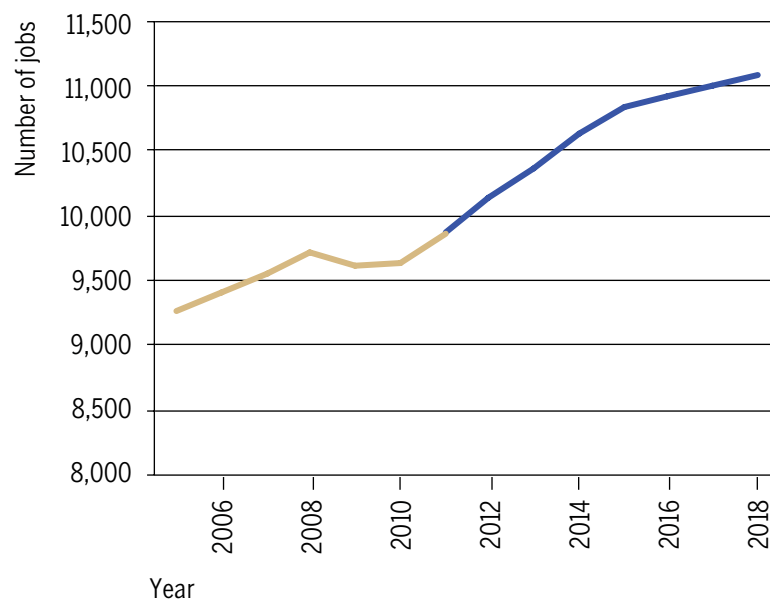
^a Some college includes postsecondary vocational certificates.

More than one-half of accountants and auditors hold a Bachelor's degree. The salary boost for an accountant or auditor with a Master's degree or better is more than \$20,000 a year, from \$66,000 to \$87,000. Although nearly one-half of CEOs obtain a Bachelor's degree, almost one-quarter hold a master's degree or better and receive an average salary increase of more than \$24,000 a year, from \$155,000 to \$179,000.

Career Cluster 5: Education and Training

Despite imminent cuts in benefits, pay, and staffing caused by state fiscal crises, job opportunities in Education and Training will still increase 14 percent through 2018 (figure 18). By 2018, a staggering 91 percent of jobs will require at least some postsecondary education and training (table 43).

Figure 18. Jobs in Education and Training will increase by 14 percent through 2018 despite cuts in benefits, pay, and staffing.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 43. Many jobs in Education and Training require a Bachelor's degree.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Education administrators, elementary and secondary school	1	5	10	6	24	55	100
Clinical, counseling, and school psychologists	0	0	0	0	5	94	100
Postsecondary teachers	0	0	3	3	18	76	100
Preschool teachers, except special education	2	15	25	14	33	12	100
Elementary school teachers, except special education	0	1	3	2	49	45	100
Secondary school teachers, except special and vocational education	0	0	2	1	48	47	100
Special education teachers, preschool, kindergarten, and elementary school	0	4	6	4	40	46	100
Librarians	0	2	9	5	24	60	100
Library technicians	3	35	20	10	22	10	100
Teacher assistants	3	31	32	15	16	3	100
Education, training, and library workers, all other	1	5	11	6	30	48	100
Coaches and scouts	2	10	20	7	45	15	100

^a Some college includes postsecondary vocational certificates.

Education and Training occupations are mostly found in the education services industry (80%); although 13 percent are also found in Health Science. Education and Training is the fifth fastest growing career cluster but eighth largest in sheer size, with an estimated 11 million jobs in 2018.

Job growth in Education and Training has been affected by the changes in the education landscape ushered in by the No Child Left Behind Act of 2001. Despite these changes in the education landscape, job growth will

continue to be strong through 2018. Growth in Education and Training is paradoxical: fast-growing demand is propelled by a new wave of education reform but constrained by budgetary problems. More than 60 percent of workers in Education and Training are in the public sector and are subject to growing fiscal pressures. In recent years, teachers and states have been fighting over benefits and pay.

The deepest employment decline took place in 2009, at the height of job losses during the recession. Still, Education and Training managed to keep dramatic decline at bay, as jobs dropped from 9.7 to 9.6 million from 2008–2009.

The increased personal attention needed to assist students in reaching standardized learning benchmarks will stimulate employment growth in Education and Training; however, budgetary constraints will somewhat limit job opportunities. Current trends in education focus on holding schools accountable for standardized test performance. Administrators, teachers, and staff often respond to these increasing demands by providing more individualized support and personalized attention to needy students; such support relies on schools being more heavily staffed. Particular legislation will require these workers to give more assistance to students with special needs, including nonnative English speakers, and more general attention to math, science, and reading preparation.

ADMINISTRATORS

School administrators are held responsible for reaching standardized learning benchmarks regardless of budgetary constraints. Increasing demands on school administrators coupled with the high number of retirements between 2008 and 2018 will create numerous job opportunities. Job growth for education administrators is expected to be 12 percent for those who work in preschools, childcare centers, or early childhood programs. Increasing government focus on the importance of structured preschool education for cognitive development will drive this growth. Job growth for elementary and secondary education administrators is expected to be 9 percent. On the other hand, jobs for instructional coordinators will increase 24 percent to keep up with schools' need to monitor student achievement and keep curricula consistent with current regulations.

In contrast, job opportunities for postsecondary education administrators are projected to grow by only 2 percent, due in part to the funding structures of postsecondary compared to elementary and secondary education. Most government funds to improve learning standards will focus on K–12 education.

TEACHERS

Expected job growth for kindergarten (15%), elementary (16%), and middle school teachers (15%), excluding special education (17%) and CTE (9%) teachers, will be above-average from 2008 to 2018 as education quality initiatives create demand for additional teachers. Many of these job opportunities will be in rural and under-performing urban schools. Growth in public school enrollment is projected to vary considerably throughout the country and will influence demand for teachers. Enrollment is projected to increase in 32 states, with the fastest growth in the West and South, but is projected to decrease in 18 states, mostly in the Northeast, upper-Midwest and Gulf Coast.¹⁹ Teachers who specialize in reading, math, and bilingual education will be most in demand. Still, budgetary constraints will keep job growth artificially below projected need.

Although overall enrollments for eligible children will decline slightly, career opportunities for preschool teachers are somewhat greater due to high job turnover and changing initiatives that emphasize early childhood education. Jobs for secondary school teachers, except those teaching special education and CTE, are predicted to grow by a moderate 9 percent, primarily due to anticipated enrollment decline.

Jobs for middle school CTE teachers will grow by only 3 percent, whereas jobs for secondary school CTE teachers will grow by 10 percent. These small figures are primarily due to increasing emphasis on the traditional classroom subjects evaluated by mandated tests, including reading, math, and science.

Job growth for special education teachers will be higher than average because standardized testing benchmarks will increasingly be extended to students with special needs; this will lead to increased demand for these teachers. Early diagnosis initiatives and funding will lead to 20 percent job growth for preschool, kindergarten, and elementary school special education teachers. Jobs for middle school special education teachers will increase 18 percent. Career opportunities for secondary school special education teachers will grow by 13 percent between 2008 and 2018.

Career opportunities for postsecondary teachers are expected to increase 15 percent and will be complemented by retirements within a large pool of eligible postsecondary teachers. Enrollment in postsecondary programs is predicted to grow as individuals increasingly seek ways to gain job market eligibility. Teachers who specialize in occupational degree programs in high-demand fields, including business and nursing, will have excellent job prospects. Similarly, adults seeking to enhance their career prospects

¹⁹ See Projections of Education Statistics to 2019. (<http://nces.ed.gov/pubs2011/2011017.pdf>).

through adult literacy, remedial education, and GED programs will create 15 percent more jobs for related teachers and instructors.

SUPPORT STAFF

Education reform will also create job opportunities for education support staff. Career opportunities for audio-visual collections specialists, librarians, and library technicians will be nearly average. As with teachers and administrators, growing enrollment and budget cuts will taper growth for these workers while maximizing their working potential. Whereas librarians are predicted to experience 8 percent job growth, it will be marginally better at 9 percent for library technicians because they offer similar services and qualifications and have lower salary requirements. User-friendly digital resources and academic research software will limit job growth for audio-visual collections specialists, librarians, and library technicians alike.

Jobs for teaching assistants at all education levels will increase 10 percent because they will be needed to assist schools in meeting new benchmarks for teaching and testing. Heightened emphasis on after-school and summer education programs will also increase demand for these workers. High turnover for teaching assistants (due to low pay and demanding work) will ensure bright prospects for individuals entering the occupation.

Job growth for curators is expected at 23 percent, mainly because of their ability to take on many different responsibilities within a wide variety of cultural institutions. Although budget cuts will affect hiring rates for museums and other educational programs, federal grants are often available to allow these institutions to meet growing demand from growing societal interest. Jobs for archivists are expected to grow at a slow 7 percent. Full-time positions for archivists and curators, as well as librarians and library technicians, are highly competitive.

Clinical, counseling, and school psychologists, as well as educational, career, and school counselors will increasingly be needed to help students and educational institutions navigate behavioral and academic pressures. Jobs for clinical, counseling, and school psychologists are projected to grow by 11 percent; for educational, career, and school counselors, by 14 percent. Counselors will see slightly better job growth due to their flexibility in taking on many disparate services for schools.

Jobs for coaches and scouts are predicted to increase 25 percent by 2018. Career prospects will be especially pronounced for coaches at private institutions because more parents will seek outside assistance to enhance their children's athletic performance. Additionally, many part-time

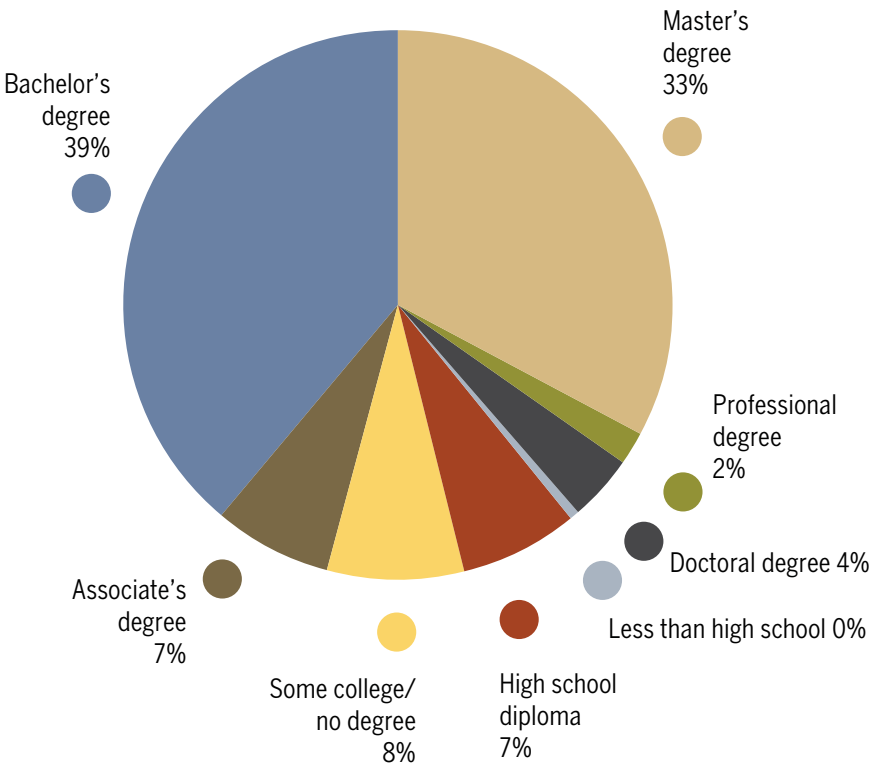
positions will be available for qualified coaches and scouts to meet the increasing demand for sports officials.

EDUCATION DISTRIBUTION OF EDUCATION AND TRAINING JOBS

Between 2008 and 2018, the share of jobs requiring a Bachelor's degree will hold strong at 39 percent (figure 19). Thirty-three percent of all Education and Training jobs will require a Master's degree; 4 percent, a doctoral degree. In total, then 72 percent of jobs in this career cluster will require a Bachelor's degree or better by 2018.

The postsecondary middle-skills job market nevertheless will make up 15 percent of jobs by 2018. Many of these positions are held by workers in support roles, such as teacher assistants (78%); and library technicians (65%).

Figure 19. Almost 80 percent of jobs in Education and Training will require a Bachelor's degree or better by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Library technicians with a Bachelor's degree or a Master's degree or better can expect a sizable increase in pay (table 44). The average library technician with a high school diploma makes \$20,000; one with a Bachelor's degree makes \$23,000. A Master's degree nearly doubles the average salary for a library technician (\$38,000). The increase in pay for a teacher assistant is not as pronounced: a teacher assistant with an Associate's degree earns \$17,428; one with a Bachelor's degree earns marginally more (\$18,334).

This pattern is similar for lead teachers, whether they teach preschool, elementary, secondary, or special education. With a Master's degree or better, they can expect an average wage increase of at least \$11,000. For example, secondary school teachers, except those in special education and CTE, with a Bachelor's degree earn \$42,000 and those with a Master's degree earn \$54,000.

Table 44. Workers in Education and Training find it difficult to earn wages above the MET without a Bachelor's degree or better.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Education administrators, elementary and secondary school	—	35,000	37,700	37,900	50,300	74,500
Clinical, counseling, and school psychologists	—	—	—	—	33,900	48,300
Postsecondary teachers	—	—	33,900	36,500	30,200	55,900
Preschool teachers, except special education	—	17,100	17,600	19,800	25,800	37,100
Elementary school teachers, except special education	—	—	20,900	—	38,500	51,500
Secondary school teachers, except special and vocational education	—	—	—	—	41,600	53,600
Special education teachers, preschool, kindergarten, and elementary school	—	21,600	22,100	26,300	38,900	51,500
Librarians	—	25,900	21,800	22,900	32,300	49,100
Library technicians	18,900	19,500	20,100	20,000	22,500	37,900
Teacher assistants	17,800	16,800	17,400	17,400	18,300	23,400
Education, training, and library workers, all other	—	29,600	32,500	31,900	39,600	54,400
Coaches and scouts	—	33,200	34,800	33,300	46,800	56,000

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

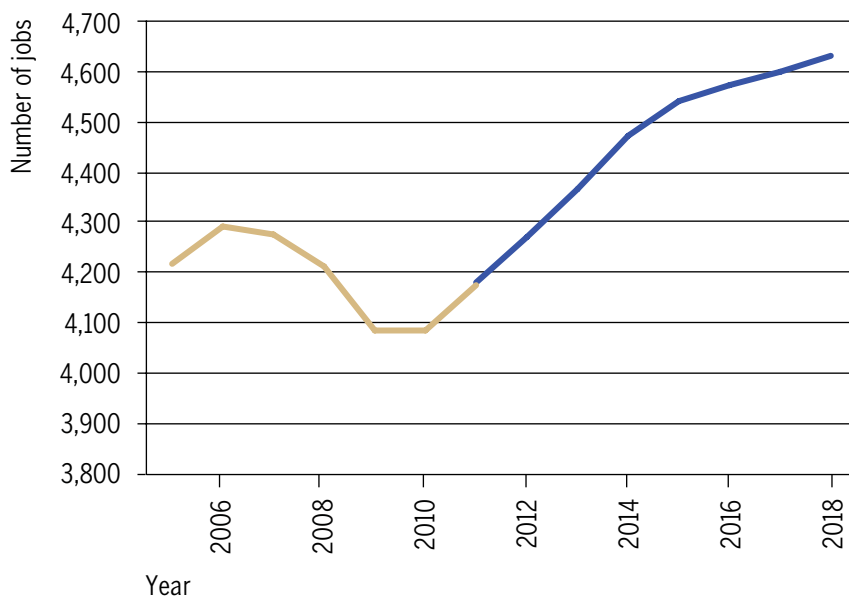
It is clear that postsecondary education is more common for workers in Education and Training. For example, 94 percent of clinical, counseling, and school psychologists hold a Master's degree, as do 60 percent of librarians. Although one-quarter of librarians hold a Bachelor's degree, the difference in pay for those with a Master's degree or better is nearly \$17,000 (from \$32,000 to \$49,000).

Career Cluster 6: Finance

Finance occupations are projected to grow by 10 percent between 2008 and 2018 (figure 20). Jobs are expected to increase by a steady 2 percent through 2015, and continue to grow, albeit more slowly, through 2018. By 2018, 85 percent will go to workers with at least some postsecondary education (table 45).

The deepest decline in Finance took place in 2008. Between 2008 and 2009, jobs fell by 3 percent from 7 to 6.8 million jobs. As the U.S. emerges from the recession precipitated by financial crises, the demand for financial expertise will rise.²⁰ Evaluating and managing risk is the most significant area of growth for this career cluster. As a result, opportunities in risk management and auditing functions, particularly for mergers and acquisitions, are projected to increase.

Figure 20. Jobs in Finance are projected to grow by 10 percent between 2008 and 2018 despite the loss of about 200,000 jobs between 2008 and 2009.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 45. Many jobs in Finance require a Bachelor's degree.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	TOTAL (%)
Claims adjusters, examiners, and investigators	1	18	25	11	40	6	100
Credit analysts	1	11	20	9	44	15	100
Financial analysts	0	3	9	3	48	37	100
Personal financial advisors	1	4	12	5	54	24	100
Insurance underwriters	1	16	23	8	45	7	100
Loan officers	1	15	26	10	41	8	100
Tax preparers	2	15	23	10	34	16	100
Financial specialists, all other	2	14	21	10	37	17	100
Actuaries	0	0	1	1	67	30	100
Insurance sales agents	1	17	27	10	39	6	100
Securities, commodities, and financial services sales agents	1	9	16	7	51	16	100
Bill and account collectors	4	33	37	11	13	2	100
Tellers	3	37	34	10	14	2	100
Brokerage clerks	2	22	32	12	27	5	100
Credit authorizers, checkers, and clerks	2	30	33	10	19	4	100
Loan interviewers and clerks	2	28	35	12	21	2	100
Insurance claims and policy processing clerks	2	30	34	13	19	2	100

^a Some college includes postsecondary vocational certificates.

Forecasting Demand Cluster by Cluster Through 2018

²⁰ The Dodd-Frank Wall Street Reform and Consumer Protection Act (Pub. L. 111-203, H.R. 4173) was signed into law by President Barack Obama in 2010. It is the most sweeping change to financial regulation in the U.S. since the Great Depression and will affect all federal financial regulatory agencies and by extension the nation's entire financial services industry.

PERSONAL FINANCIAL ADVISORS AND SALES REPRESENTATIVES

The low barrier to entry and high potential income draw many individuals to jobs as personal financial advisors. Career opportunities for these workers are expected to increase by 30 percent between 2008 and 2018. Jobs for insurance sales agents are projected to increase by 12 percent; for securities, commodities, and financial services sales agents, by 9 percent. Job growth for these workers will be strongly influenced by the aging population who will need services to manage their retirement savings, as well as advice about health and long-term-care insurance. Job growth for insurance sales agents in particular is related to several trends: an increase in the volume and complexity of financial products, a rise in population, and an increase in disposable income to spend on automobiles, homes, and high-priced equipment and valuables that require insurance. Any increase in business will, in turn, increase the need for insurance coverage for product liability, workers' compensation, employee benefits, and pollution liability insurance. Consequently, demand for insurance sales agents will increase as well.

FINANCIAL ANALYSTS AND OFFICERS

Jobs for financial analysts will increase 20 percent by 2018. Financial analysts will be in demand because of the growing diversification of global investments and growth in assets under management. An increase in the number of mutual funds and hedge funds will lead to greater demand for financial analysts to research and recommend investments. In addition, as international investment increases, there will be greater demand for specialized knowledge of particular regions and commodities.

Growth in healthcare, especially in health insurance, will also increase demand for actuarial services. However, the downsizing of actuarial jobs, especially for pension actuaries, is expected in the insurance industry and reflects the decline of defined benefit plans and the rise of options such as 401k plans.

Job growth for credit analysts is expected to be very robust, between 14 and 19 percent through 2018. Due to their regulatory nature, many of these jobs are opening in Washington, DC. These jobs will be in the public sector as the federal government starts to hire people to work on loans absorbed through the mortgage relief program.

Whereas jobs for loan officers are expected to grow only 10 percent, jobs will decline for insurance underwriters by 4 percent. As with related

occupations, economic and population growth are factors for increasing loans, and therefore work for loan officers. Greater automation in lending will lead not only to tapered growth for loan officers, but declining job opportunities for insurance underwriters.

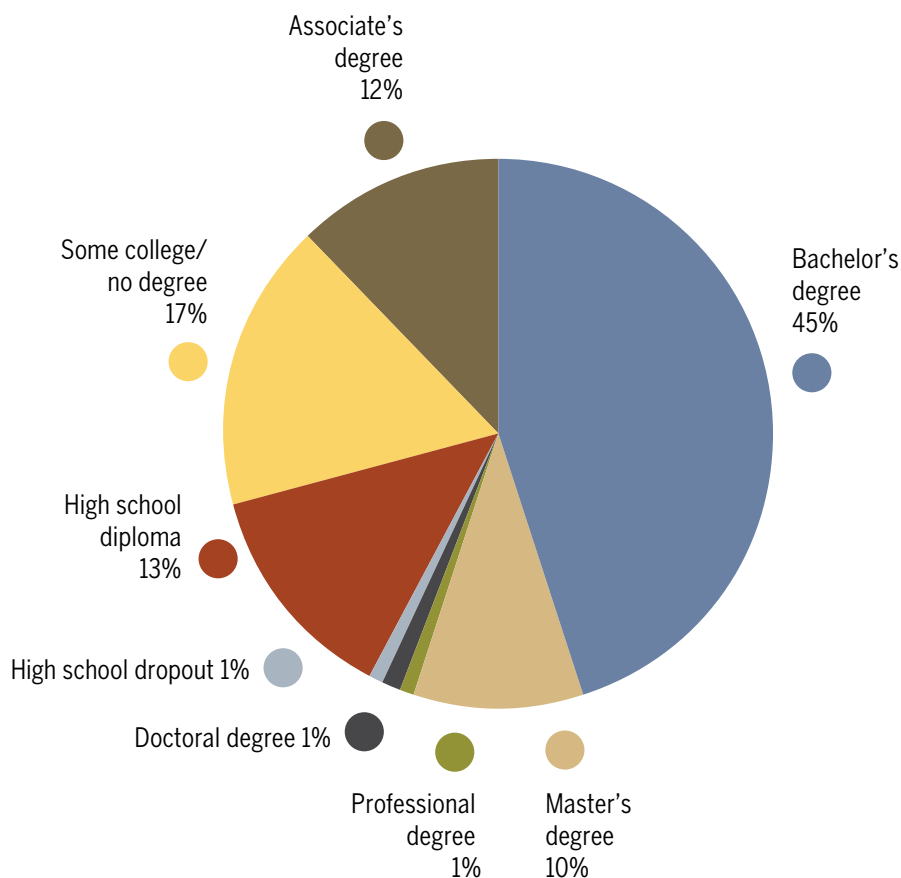
CLERKS AND SUPPORT STAFF

Projected job growth for support staff is expected to underperform the national industry average with few exceptions. Jobs for insurance claims and policy processing clerks are expected decline by 2 percent between 2008 and 2018. Similarly, jobs for loan interviewers and clerks, as well as tellers, will grow by only 4 and 6 percent, respectively. This decline is expected in large part due to online loan and financial services and productivity gains from computer software that reduces the need for many supportive roles. Job growth will be further reduced due to industry consolidation and corporate downsizing. By contrast, bill and account collectors are projected to experience 19 percent job growth due to the increased recovery rates expected by collection agencies for outstanding debt during this period of economic recovery.

EDUCATION DISTRIBUTION OF FINANCE JOBS

Between 2008 and 2018, the share of jobs requiring a Bachelor's degree will increase from 40 to 45 percent (figure 21). Moreover, 10 percent will require a Master's degree; 2 percent, a professional or doctoral degree. Eighty-five percent will require at least some postsecondary education and training by 2018. Although this career cluster is dominated by workers with a Bachelor's degree or better, the postsecondary middle-skills job market will still make up 29 percent of all Finance jobs by 2018.

Figure 21. Fifty-seven percent of jobs in Finance will require a Bachelor's degree or better by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

The postsecondary middle-skills job market is heavily represented in this career cluster: more than one-third of insurance sales agents, loan officers, and insurance claims and policy processing clerks fit this category. Salaries for these positions increase significantly for a worker with a Bachelor's degree (table 46). Whereas insurance sales agents with a Bachelor's degree earn more than \$30,000, loans officers make \$20,000 more, and insurance claims and policy processing clerks earn almost \$10,000 more.

Table 46. In several Finance jobs, increasing educational attainment by one level can increase one's wages dramatically.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Claims adjusters, examiners, and investigators	—	42,300	43,600	45,400	55,100	62,700
Credit analysts	—	37,000	42,800	40,900	55,600	101,100
Financial analysts	—	37,700	47,700	73,600	100,100	177,100
Personal financial advisors	—	52,900	65,100	60,100	100,800	132,000
Insurance underwriters	—	44,900	47,900	47,300	70,700	97,000
Loan officers	—	47,800	49,600	51,800	70,500	99,000
Tax preparers	—	22,400	24,300	26,100	47,700	94,600
Financial specialists, all other	—	44,900	51,000	45,100	88,600	138,200
Actuaries	—	112,200	64,300	47,700	121,500	122,900
Insurance sales agents	—	41,400	46,300	46,300	77,000	91,300
Securities, commodities, and financial services sales agents	—	59,700	68,000	63,500	125,800	196,300
Bill and account collectors	26,700	30,300	32,200	33,700	35,100	—
Tellers	22,900	22,700	23,300	22,400	24,600	—
Brokerage clerks	—	39,000	42,400	47,000	66,100	76,400
Credit authorizers, checkers, and clerks	—	35,100	39,900	40,900	54,700	127,300
Loan interviewers and clerks	—	37,700	37,200	39,900	44,500	—
Insurance claims and policy processing clerks	—	31,800	32,500	33,100	42,500	—

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

Most insurance claims and policy processing clerks make below the MET of \$35,000. Some workers, such as loan interviewers and clerks, earn a high wage regardless of educational attainment. More than 75 percent of these jobs are held by workers with postsecondary middle skills. Loan interviewers and clerks with a high school diploma earn \$38,000. Similarly, more than 40 percent of credit analysts have postsecondary middle skills. Credit

analysts with some college/no degree earn \$43,000. Although one-quarter of personal financial officers complete a Master's degree, the more than one-half with only a Bachelor's degree still make a high \$101,000.

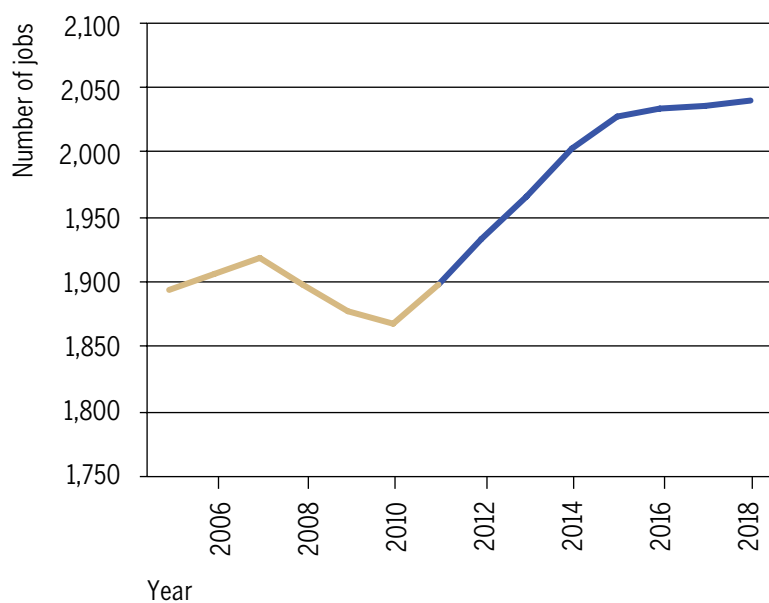
Personal financial officers are among the most highly trained and highly compensated in this career cluster. In addition to formal study in a related field, personal financial officers must comply with state license requirements. Workers who offer direct investment advice to the public or negotiate insurance policies, securities, stocks and bonds on behalf of a client must possess an appropriate license and registration.

Most state licenses have a continuing-education component. For example, insurance sales agents who sell financial products must pass the Series 6 or Series 7 licensing exam issued by the Financial Industry Regulatory Authority. Actuaries must complete the rigorous process of becoming a professional in their field by following the guidelines of the Society of Actuaries or the Casualty Actuarial Society, a process that can take more than five years to complete. Voluntary certifications, such as the Certified Financial Planner credential, are also used by professionals in this career cluster.

Career Cluster 7: Government and Public Administration

Jobs in Government and Public Administration are projected to grow by 8 percent between 2008 and 2018 (figure 22). By 2018, this will be the smallest career cluster in terms of size, employing just over 2 million people. However, 69 percent of jobs will require at least some postsecondary education and training by 2018 (table 47).

Figure 22. Jobs in Government and Public Administration will be affected by budget constraints well into the future.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 47. Many jobs in Government and Public Administration require a Bachelor's degree.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Postmasters and mail superintendents	0	1	5	2	36	56	100
Compliance officers, except agriculture, construction, health and safety, and transportation	1	12	20	9	40	18	100
Appraisers and assessors of real estate	1	14	28	10	40	7	100
Financial examiners	0	7	9	4	62	18	100
Tax examiners, collectors, and revenue agents	1	19	25	9	39	9	100
Economists	—	1	0	0	28	71	100
Urban and regional planners	0	0	3	2	38	56	100
Detectives and criminal investigators	0	9	25	12	42	11	100
Court, municipal, and license clerks	1	29	36	13	16	4	100
Eligibility interviewers, government programs	2	15	29	15	34	5	100
Interviewers, except eligibility and loan	3	27	35	13	17	5	100
Meter readers, utilities	6	46	31	10	6	1	100
Postal service clerks	3	35	37	12	12	1	100
Postal service mail carriers	3	37	37	11	11	1	100
Postal service mail sorters, processors, and processing machine operators	3	34	36	12	14	1	100
Statistical assistants	1	21	31	13	26	8	100
Transportation inspectors	6	33	32	13	13	2	100

^a Some college includes postsecondary vocational certificates.

As federal, state and local governments alike face record budgetary shortfalls, they continue to make difficult decisions about where and how to cut spending. Governments strapped for cash are currently increasing furlough days, instituting layoffs, and negotiating wage freezes with their

employees. The choices lawmakers make in response to the continued budgetary constraints inflicted by the recession will play a central role in public-sector career opportunities well into the future.

Despite persistent calls for smaller government, the public sector remains an important countercyclical source of employment. Job opportunities in federal, state, and local government remain relatively stable. Throughout the recent recession, hiring in the public sector remained positive and has just started to adjust downward as the economy recovers.

Government workers are often accused of being overcompensated. However, after controlling for education, experience, hours of work, organizational size, gender, race, ethnicity, and disability, data for employee wages and benefits indicate no evidence that government workers are overpaid (Allegretto & Keefe, 2010).

Public sector jobs can be found in a range of career clusters, including Education and Training; Human Services; and Law, Public Safety, Corrections, and Security. Tight budgets and projected hiring freezes will limit career opportunities for many public employees. Still, there will be job growth in most occupations. Although 71 percent of jobs are in the public sector, 25 percent are in the private sector. Some occupations, such as meter readers, are more likely to be found in the private sector.

LEGISLATORS AND LEGAL WORKERS

As expected, job growth for legislators will be close to zero between 2008 and 2018. On the other hand, average growth is expected for court, municipal, and license clerks.

TAX AND REGULATION PROFESSIONALS

Due to an increased regulatory environment in the aftermath of the recession, tax and regulation professionals should expect an upsurge in employment opportunities. Job growth will be highest for compliance officers and financial examiners; it is expected to be more than 20 percent through 2018.

Job openings for tax examiners, collectors, and revenue agents are expected to increase between 7 and 13 percent, close to the national average.

SOCIAL SCIENTISTS

Agencies and organizations will seek highly specialized candidates to keep up with growing economic complexity. Jobs for political scientists are expected to increase 19 percent between 2008 and 2018; for

anthropologists and archeologists, 28 percent. Close to average growth (11%) is expected for historians and statisticians. Related and supporting social science jobs will see varying patterns of growth. Whereas jobs for survey researchers are projected to increase by 30 percent, jobs for statistical assistants will increase by only 3 to 6 percent; for social science research assistants, by 14 to 19 percent. Similarly, jobs for interviewers, except eligibility and loan interviewers, will expand by 16 percent to keep up with the growing demand from politicians and government agencies for polling data. The predicted 9 percent job growth for eligibility interviewers working in government programs is mainly driven by the growing number of retirees who will qualify for Social Security and other government entitlement programs. Online surveys and questionnaires will somewhat dampen growth for other interviewers.

POSTAL SERVICE WORKERS

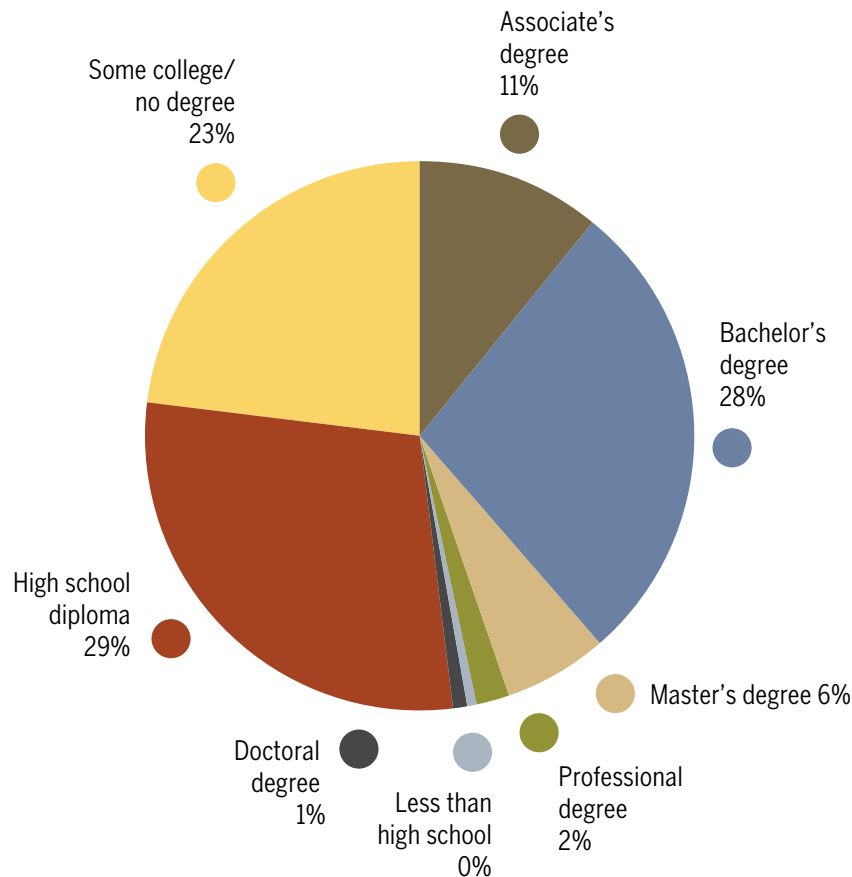
Technology has hit employment in the postal service hard. The widespread use of e-mail and automated bill payment systems has limited job growth for postal workers in the public sector. As a result, the number of jobs for postmasters, mail superintendents, and postal service clerks will decline dramatically, more than 10 percent by 2018. Automated mail sorting equipment is responsible for the 30 percent decline in job opportunities for postal service mail sorters, processors, and processing machine operators. This equipment has also limited growth somewhat for postal service mail carriers. Although automated sorting will make mail carriers more efficient with distribution, demographic growth and urban sprawl will keep job decline from slipping much below 1 percent.

EDUCATION DISTRIBUTION OF GOVERNMENT AND PUBLIC ADMINISTRATION JOBS

By 2018, 35 percent of jobs will require a Bachelor's degree or better (figure 23). Between 2008 and 2018, the share of jobs requiring a Bachelor's degree will increase from 24 to 28 percent. Six percent will require a Master's degree by 2018. Still, the majority of jobs will go to workers with a Bachelor's degree or less: 34 percent will require a postsecondary vocational certificate, an Associate's degree, or a state-mandated license or certification by 2018. Less than one-third (29%) of workers will need only a high school diploma.

Education requirements vary widely for professionals in this career cluster. Legislators and legal workers typically require significant training. Detectives and criminal investigators receive most of their training from police academies. Although some related experience substitutes for a

Figure 23. More than one-third of jobs in Government and Public Administration will require a Bachelor's degree or better by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Bachelor's degree, tax and regulation professionals must have one. Urban and regional planners, and social scientists require the highest education levels: more than one-half hold a Master's degree or better. Appraisers and assessors of real estate must obtain a license or certification to meet qualification standards.

Interestingly, the 40 percent of real estate appraisers and assessors with a Bachelor's degree earn \$15,000 more than their colleagues with only some college/no degree education (table 48). Interviewers typically need a high school diploma; new employees receive sufficient on-the-job training. Only about one-quarter of interviewers, except eligibility and loan interviewers, hold only a high school diploma. Eligibility interviewers for government programs possess higher education levels and are more highly

Forecasting Demand Cluster by Cluster Through 2018

compensated in return. Whereas interviewers with a high school diploma make \$25,000, eligibility interviewers with a Bachelor's degree or better earn more than \$40,000.

Likewise, a career in the postal service does not, on average, require postsecondary education. Some workers are highly educated; however, more than one-half of postmasters and mail superintendents have a

Table 48. Even within the same Government and Public Administration job, those with higher levels of educational attainment consistently earn more.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Postmasters and mail superintendents	—	56,100	68,200	69,800	84,700	122,400
Compliance officers, except agriculture, construction, health and safety, and transportation	—	48,400	54,100	54,900	70,100	89,000
Appraisers and assessors of real estate	—	32,700	36,100	33,400	51,200	59,100
Financial examiners	—	44,800	49,600	37,100	76,400	92,800
Tax examiners, collectors, and revenue agents	—	39,400	44,900	42,800	56,800	63,800
Economists	—	—	—	—	80,900	119,800
Urban and regional planners	—	—	62,400	—	60,300	66,300
Detectives and criminal investigators	—	59,300	65,500	64,500	75,500	82,500
Court, municipal, and license clerks	—	32,800	34,400	35,500	41,300	41,900
Eligibility interviewers, government programs	—	39,700	38,700	36,500	43,700	47,000
Interviewers, except eligibility and loan	19,800	25,400	26,600	27,700	32,600	50,400
Meter readers, utilities	27,700	35,500	39,400	41,000	38,800	—
Postal service clerks	39,700	45,900	47,000	46,700	50,600	—
Postal service mail carriers	41,900	45,400	47,500	47,100	49,300	—
Postal service mail sorters, processors, and processing machine operators	37,800	45,100	47,300	47,200	51,500	—
Statistical assistants	—	37,800	40,600	40,500	49,300	65,700
Transportation inspectors	28,000	45,700	48,700	50,000	57,400	—

^a Some college includes postsecondary vocational certificates.

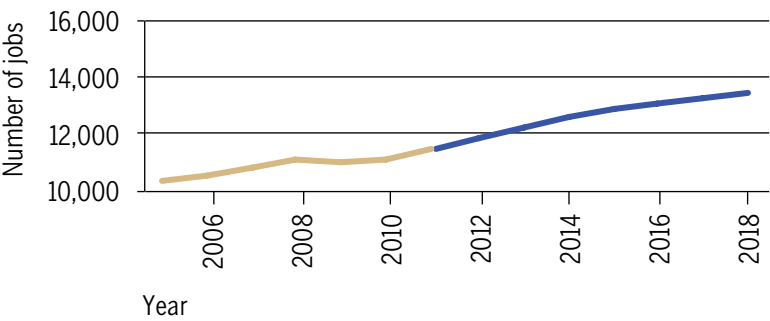
— Cell data suppressed due to small sample size.

Master’s degree or better. This translates to an average salary increase of \$37,000, from \$85,000 with a Bachelor’s degree to \$122,000 with a Master’s degree or better. The more than one-third of postal service mail carriers with a high school diploma earn an average of \$45,000 annually.

Career Cluster 8: Health Science

Jobs in Health Science, the fastest growing career cluster, are projected to grow 23 percent between 2008 and 2018 (figure 24). The deepest decline took place in 2009, at the height of job losses during the recession. By 2018, 83 percent will go to workers with at least some postsecondary education and training (table 49).

Figure 24. Jobs in Health Science—the fastest-growing career cluster—are projected to grow by 23 percent between 2008 and 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 49. The education level required for jobs in Health Sciences varies widely.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Pharmacists	0	0	1	1	42	55	100
Physicians and surgeons	0	0	0	0	1	98	100
Registered nurses	0	1	4	38	44	12	100
Occupational therapists	0	0	1	8	56	35	100
Physical therapists	0	2	2	7	40	49	100
Respiratory therapists	0	2	12	59	23	4	100
Speech-language pathologists	0	1	1	1	8	90	100
Medical and clinical laboratory technologists	1	11	18	18	44	7	100
Dental hygienists	0	2	5	57	31	5	100
Radiologic technologists and technicians	0	8	20	47	20	4	100
Pharmacy technicians	2	26	35	20	14	2	100
Licensed practical and licensed vocational nurses	1	19	56	17	4	3	100
Medical records and health information technicians	3	33	34	17	12	2	100
Home health aides	15	40	30	8	6	2	100
Dental assistants	3	31	40	15	7	3	100
Medical assistants	4	28	39	18	9	3	100

^a Some college includes postsecondary vocational certificates.

The healthcare industry in the U.S. has steadily grown in importance during the last two decades. Today, it is larger than ever before, accounting for approximately 16 percent of GDP. The widespread controversy over how to pay for the growing need for many services, which has enjoyed much attention in the last few years, centers on passage of the healthcare reform bill, The Patient Protection and Affordable Care Act.²¹ The goals of this new legislation are ambitious: it aims to insure an additional 32 million citizens by 2019 and modify the way Americans obtain insurance and the way government regulates it.

²¹ Public Law 111-148 was signed by President Barack Obama on March 23, 2010.

The Patient Protection and Affordable Care Act

Some provisions of the bill include:

- Fines for individuals without adequate insurance coverage
- Expansions in Medicaid eligibility for people earning up to 133 percent of the federal poverty level (FPL)
- Subsidized insurance premiums for people earning up to 400 percent of the federal poverty level (FPL)
- Incentives for businesses to provide healthcare insurance
- Incentives for states to experiment with health provision models to find savings
- New state insurance markets through health insurance exchanges
- No annual coverage caps for insurers
- No denials for insurance coverage and claims based on pre-existing conditions
- Support for medical research

The effect on jobs in this career cluster depends on the new legislation's effect on spending. Faced with record budget shortfalls, the task of balancing budgets while also expanding coverage, especially at the state level, is daunting.

Despite these concerns, the healthcare industry is still growing at breakneck speed. It is one of two industries that added jobs throughout the recession and promises growth and opportunity over the next decade.

Health Science occupations are mostly found in the healthcare industry (85%). Eleven percent of these occupations are also found in Marketing, Sales, and Service (5%); Business, Management, and Administration (3%); and Education and Training (3%).

Baby boomers are expected to need more medical care in the next decade, and this increase will have a domino effect on job growth. Projected growth patterns for key healthcare positions shed some light on how these areas will adapt to trends in patient preferences between 2008 and 2018. Home healthcare services are projected to increase by 46 percent, followed by medical and diagnostic laboratories (40%), outpatient care centers (39%), and physicians' offices (34%). Ambulatory healthcare is also expected to grow significantly: patients have been choosing outpatient care and home healthcare over hospital care. The procedures and treatments Medicare and insurance companies will pay for will affect the patient's choice of specialist, treatment, and treatment location. Medicare and insurance companies are expected to play a large role in job growth for ambulatory healthcare between 2008 and 2018.

HEALTHCARE PROFESSIONAL AND TECHNICAL OCCUPATIONS

Between 2008 and 2018, jobs for physicians and surgeons, particularly for specialists, are expected to increase by 26 percent. Specialized healthcare professionals and technicians will see extensive job growth between 2008 and 2018. Whereas jobs for general dentists will increase 15 percent, orthodontists (20%) and prosthodontists (28%) are expected to be in greater demand as more of the population invests in the health of their smiles, including the elderly, who will be increasingly fitted for dentures and similar products. Similarly, surgical technologists' jobs are expected to grow by 25 percent by 2018; for cardiovascular technologists and technicians, by 24 percent.

Jobs for registered nurses are projected to increase by 23 percent; for licensed practical and licensed vocational nurses, by 22 percent. This surge

in demand for nurses has put additional pressure on nursing schools to increase enrollment and replace retiring nurses.

The demand for medical scientists will depend on the growth and success of technological development. Between 2008 and 2018, jobs for medical scientists, except epidemiologists, are expected to increase by 40 percent. Conversely, jobs for epidemiologists will grow by 15 percent. Expected growth areas for these workers are in cancer, epidemics, antibiotic resistance, and research and development of drugs and therapies to treat HIV.

Occupational therapists and speech-language pathologists treat an increasing number of adolescents who need disability therapy or treatment for some other condition. Between 2008 and 2018, jobs for occupational therapists are expected to increase by 26 percent. Jobs for occupational therapist assistants, a healthcare support occupation, are expected to grow by 30 percent. Jobs for speech language pathologists are projected to grow by 19 percent and audiologists, by 25 percent, mostly to address the needs of an aging population. Jobs for mental health and substance abuse social workers will increase by 20 percent. Jobs for physical therapists are expected to increase by 30 percent due to the increasing number of heart attack and stroke patients expected as the population ages.

HEALTHCARE SUPPORT OCCUPATIONS

Healthcare support occupations will provide the healthcare industry with competent, cost-effective workers. Expanding services provided by support workers will allow healthcare professionals to treat patients more efficiently. For example, jobs for dental hygienists and assistants are expected to increase 36 percent between 2008 and 2018. Dental hygienists and dental assistants are increasingly expected to take on tasks the general and specialty dentists might have otherwise handled. Similarly, a certified physician's assistant will perform more routine procedures than a more highly trained, highly compensated physician. Jobs for physician's assistants are projected to increase by 41 percent.

Pharmacy technicians will be taking over more responsibilities not only from the pharmacists, but also from related healthcare support workers. Whereas jobs for pharmacists are predicted to grow by 17 percent between 2008 and 2018, pharmacy technician jobs are expected to increase 31 percent. Jobs for pharmacy aides are expected to decline by 6 percent as their office duties are taken over by the more highly trained technicians.

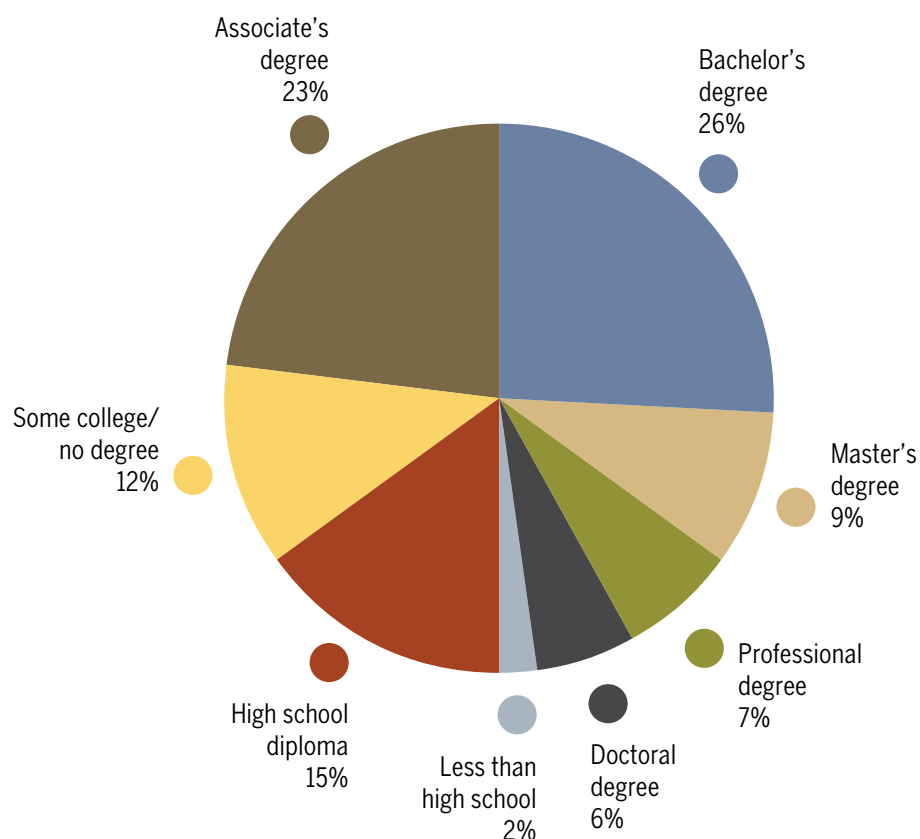
Home health aides, nursing aides, orderlies, and attendants are among the fastest growing occupations in Health Science. Many of these support occupations do not require a high level of education or substantial training and tend to have high turnover rates and relatively low wages. Jobs for home health aides are projected to increase 50 percent between 2008 and 2018 due to the aging population opting for home healthcare rather than long-term care facilities. Jobs for nursing aides, orderlies, and attendants will grow 19 percent to care for the elderly in long-term care facilities.

Finally, healthcare support occupations draw from a diverse swath of the Health Science labor market. Some healthcare support occupations fill a mostly administrative role. Jobs for medical transcriptionists are projected to grow 11 percent. Others who work with the public to discuss prevention and lifestyle choices, such as health educators, will see 18 percent job growth by 2018.

EDUCATION DISTRIBUTION OF HEALTH SCIENCE JOBS

Between 2008 and 2018, the proportion of jobs requiring Bachelor's degrees will increase from 24 to 26 percent. Nine percent will require a Master's degree by 2018; 6 percent, a doctoral degree; and 7 percent, a professional degree (figure 25). Although 48 percent will require at least a Bachelor's degree by 2018, the postsecondary middle-skills job market will still make up 35 percent of jobs.

Figure 25. Almost half of jobs in Health Science will require a Bachelor's degree or better by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

However, jobs in this career cluster can be divided into two broad categories distinguished by vastly different educational requirements. One category, Health Science professional and technical occupations are dominated by workers with a Bachelor's degree or better. Sixty-three percent will require a Bachelor's degrees or better by 2018; 25 percent, an Associate's degree. The second group is dominated by those with postsecondary middle skills or less. Health Science support occupations will require workers with a high school diploma (34%); some college/no degree or postsecondary certificate (27%); or an Associate's degree (21%) by 2018.

Compensation in Health Science is also highly skewed, favoring workers with high educational attainment (table 50). For example, physicians and surgeons are at the top of the totem pole and earn, on average, \$153,000.

At the bottom are dietetic technicians who earn, on average, \$27,000. Within support occupations, there is less discrepancy, but earnings are mostly concentrated at lower levels.

Table 50. For registered nurses, dental hygienists and several other Health Science jobs, workers with higher levels of educational attainment consistently earn wages higher than the MET.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Pharmacists	—	—	—	—	90,700	96,600
Physicians and surgeons	—	—	—	—	—	165,200
Registered nurses	—	—	50,900	51,500	57,300	70,100
Occupational therapists	—	—	—	37,100	50,800	50,700
Physical therapists	—	—	—	41,800	58,800	59,700
Respiratory therapists	—	—	46,300	48,200	53,300	56,000
Speech-language pathologists	—	—	—	—	40,600	48,400
Medical and clinical laboratory technologists	—	35,200	35,500	39,700	48,300	51,900
Dental hygienists	—	—	38,600	43,800	47,000	49,100
Radiologic technologists and technicians	—	43,900	47,200	50,500	54,100	62,100
Pharmacy technicians	—	29,200	30,300	32,500	32,500	33,900
Licensed practical and licensed vocational nurses	—	33,900	36,500	36,100	44,600	42,900
Medical records and health information technicians	26,700	28,600	29,300	30,500	35,500	—
Home health aides	18,900	22,100	22,500	25,500	26,900	—
Dental assistants	24,600	26,500	27,700	28,100	29,000	30,200
Medical assistants	20,900	24,400	25,400	25,700	29,800	36,800

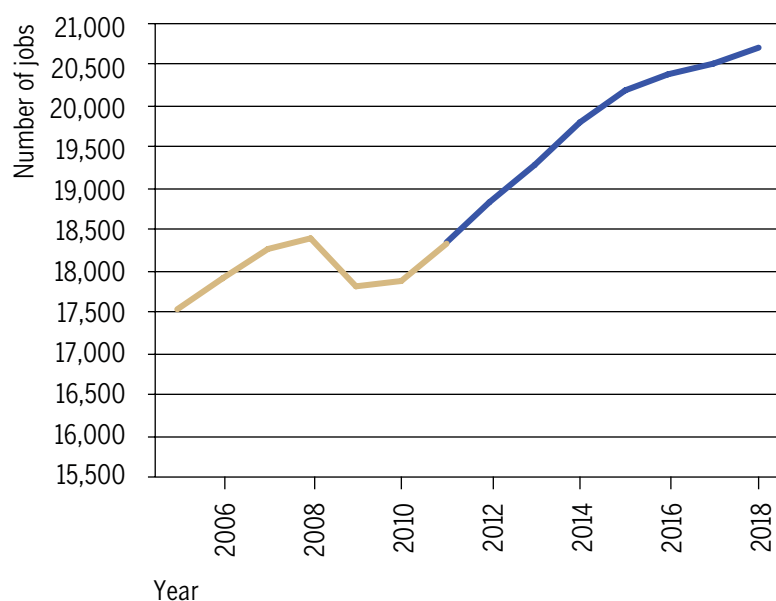
^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

Career Cluster 9: Hospitality and Tourism

Jobs in Hospitality and Tourism are projected to grow by 12 percent between 2008 and 2018 (figure 26). The career cluster is expected to fluctuate slightly thorough 2014 and grow by a steady 1 percent from 2015 to 2018. By 2018, 40 percent of jobs will go to workers with at least some postsecondary education (table 51).

Figure 26. Jobs in Hospitality and Tourism are projected to grow by 12 percent between 2008 and 2018; however, many jobs are entry-level, seasonal, and part-time.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 51. Many jobs in Hospitality and Tourism require a high school diploma or middle skills.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Food service managers	10	30	27	9	20	4	100
Self-enrichment education teachers	2	12	20	9	37	20	100
First-line supervisors/managers of food preparation and serving workers	14	37	27	8	12	2	100
Cooks, fast food	33	42	15	4	4	1	100
Food preparation workers	32	40	16	5	6	1	100
Bartenders	8	31	34	9	16	2	100
Combined food preparation and serving workers, including fast food	22	47	20	5	5	1	100
Counter attendants, cafeteria, food concession, and coffee shop	24	44	19	4	8	2	100
Waiters and waitresses	16	35	28	7	13	2	100
Dining room and cafeteria attendants and bartender helpers	32	43	15	4	6	1	100
Dishwashers	47	38	9	2	3	1	100
Hosts and hostesses, restaurant, lounge, and coffee shop	15	34	28	8	13	3	100
First-line supervisors/managers of housekeeping and janitorial workers	17	41	24	8	9	2	100
Janitors and cleaners, except maids and housekeeping cleaners	28	46	17	5	4	1	100
Maids and housekeeping cleaners	41	39	12	3	4	1	100
Amusement and recreation attendants	9	32	27	9	19	3	100
Hotel, motel, and resort desk clerks	7	34	34	9	14	2	100

^a Some college includes postsecondary vocational certificates.

The deepest decline took place in 2009, at the height of job losses during the recession. Between 2008 and 2009, jobs fell by 3 percent, from 1.8 to 1.7 million jobs.

This career cluster includes many entry-level, seasonal, and part-time jobs. The nature of hospitality jobs means that the career cluster has traditionally avoided outsourcing: a lot of hands-on labor and time are needed to prepare meals and hotel rooms for business and leisure travelers. A significant portion of the jobs are located in urban areas, clustered around cities with high concentrations of business or tourist attractions.

Many factors have intensified the division of labor within these occupations, boosting competition and educational requirements in the process. The sharp decline of travel and luxury spending brought on by the recession only intensified competition as restaurant prices and average daily hotel rates were reduced to attract business.

Entertainment services for travelers and locals alike will expect a boost during this period from the aging population hoping to enjoy retirement. The exception will be staffing reductions in the gaming industry caused by the automation of services.

As jobs in this career cluster require more computer, leadership, and efficiency skills, workers will be required to increase their education and training. Though many of these jobs are temporary, many workers view the skills they acquire as a chance to move into higher paid, more stable managerial positions within the career cluster. However, workers with an Associate's degree or better are predicted to take many managerial positions sought by industry veterans with postsecondary middle-skills training: assistant hotel managers, for example, will be recruited from two- and four-year hospitality management programs rather than strictly from within.

FOOD SERVICE

Food service occupations are expected to meet rising competition from centralized management teams and food processing locations. Food service providers, including companies, schools, and recreation facilities, are expected to increasingly contract out their food services. Food contractors, in turn, will centralize food preparation facilities that complete the initial processing of ingredients for a variety of restaurants and eating establishments.

Central kitchens, along with wholesale and distribution facilities, will reduce labor costs and food preparation time. As a result, jobs for food

preparation workers will increase by only 6 percent between 2008 and 2018. Job opportunities for short-order cooks will not increase because many simple preparation tasks will be completed in a centralized, offsite facility. Likewise, job opportunities for bakers will not increase because centralized facilities have large baking capacity. Job prospects for combined food preparation and serving workers, including fast food, however, are projected to increase by 14 percent due to consumer reliance on quick meals and prepared foods.

Technological advances will make dining more efficient. Many eating establishments will incorporate online or call-in ordering for carry-out or delivery items. Waiters and waitresses will use communication technology to send orders more quickly and accurately to kitchen staff. Communication technology used by wait staff can be incorporated with computerized purchasing programs for food and supplies. Computer systems will make inventory control more accurate, reducing food waste and delays in ordering essential ingredients. Job growth for food service managers is projected to be 3 to 6 percent due to a decreased workload brought on by easier ways to track staff pay and scheduling. This efficiency, coupled with the projected increase in fast-food dining, translates into slow job growth of 6 percent for waiters and waitresses. Staffing efficiency will also limit job growth to 6 percent for hosts and hostesses in restaurants, lounges, and coffee shops, as well as dining room and cafeteria attendants and bartender helpers between 2008 and 2018. With less need for skilled food service managers, more responsibility will be delegated to lower paid, first-line supervisors/managers of food preparation and serving workers, who will see a 7 percent increase in job prospects.

Despite declines in job prospects due to food-service efficiency, many workers will still be needed. Jobs for cooks, including fast food, bartenders, dishwashers, and counter attendants for cafeterias, food concessions, and coffee shops will grow by 10 percent.

HOTEL AND LODGING SERVICES

The career cluster is expected to centralize management and streamline staffing, modeling the efficiency processes of the food service industry. Chain-affiliated hotels are projected to consolidate regional management, slightly limiting job prospects for lodging managers to 3 to 6 percent growth. Job prospects for janitors, cleaners, maids, housekeeping cleaners, and their corresponding first-line supervisors/managers are also expected to grow by only 3 to 6 percent.

As with Marketing, Sales, and Service, future success in hotel and lodging is dependent on the quality of customer service. Jobs for hotel, motel, and resort desk clerks, concierges, and meeting and convention planners are expected to grow between 14 and 19 percent. Job opportunities for travel agents, on the other hand, are expected to show little or no growth from 2008 to 2018 as more small or independent hotels join large and chain hotels and rely on online reservation systems. Likewise, career opportunities for reservation and transportation ticket agents and travel clerks are projected to increase by 8 percent, slightly behind the national average.

Increased competition caused by more diverse hotels joining online reservation systems is expected to lead to full-service hotels providing alternative lodging options for frugal travelers. For example, hotels are expected to outsource food services or discontinue them all together. Outsourcing food services will reduce labor costs, just as the food service industry continues to implement cost and timesaving strategies.

ENTERTAINMENT SERVICES

Growth in disposable income will create job opportunities in the entertainment and gaming industry. As with hotel and lodging services, companies will continue to invest in quality customer service. Jobs for recreation workers are estimated to grow by 15 percent, particularly as more event organizers are needed to serve the aging population. Sporting events will continue to be popular, leading to 7 to 13 percent job growth for athletes and sports competitors, umpires, referees, and other sports officials, as well as locker-room, coatroom, and dressing-room attendants.

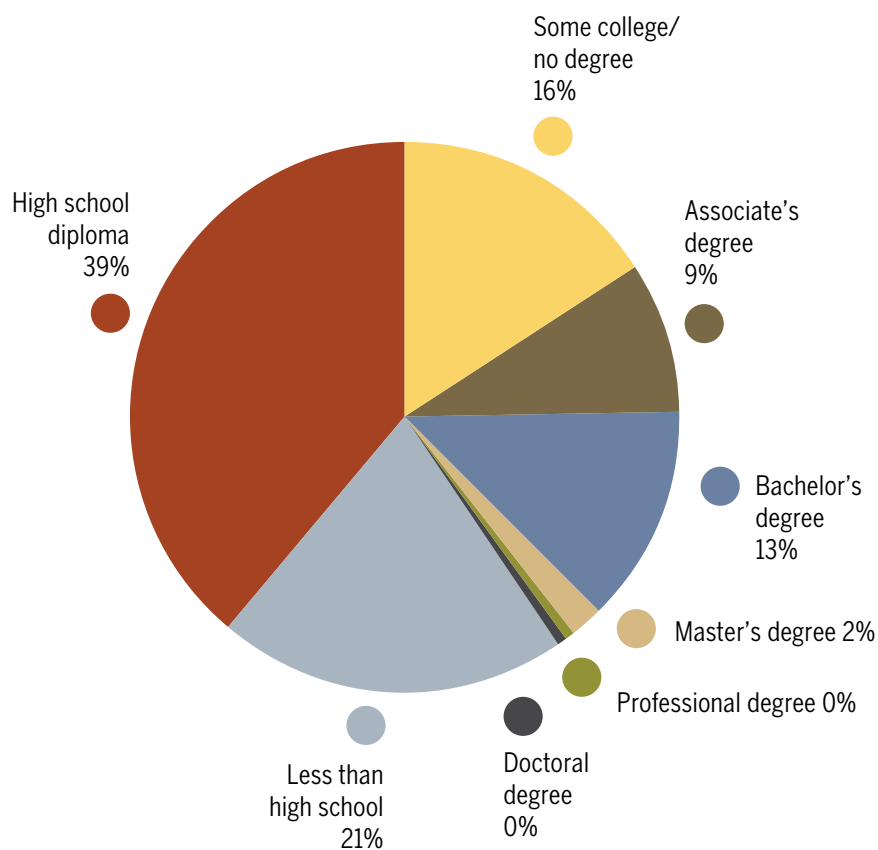
New casino development on Native American reservations and racetracks and relaxed state regulations for gaming are projected to result in growth in the gaming industry. Job growth will be above average for gaming managers, gaming supervisors, gaming and sports book writers and runners, and gaming service workers. Jobs for slot-key persons are predicted to grow by only 3 percent, as electronic table games limit job prospects in some areas. Likewise, career opportunities for gaming-cage and gaming-change workers and booth cashiers will decline by more than 10 percent.

The motion picture and theater sectors are expected to continue to attract the public. As a result, job growth for ushers, lobby attendants, and ticket takers, as well as entertainment attendants and related workers, is expected to be between 14 and 19 percent. Costly digital projectors are expected to replace complex metal-reel systems currently used by movie theaters; therefore, job growth for motion picture projectionists is expected to be only 1 percent.

EDUCATION DISTRIBUTION OF HOSPITALITY AND TOURISM JOBS

Between 2008 and 2018, the share of jobs requiring a Bachelor's degree will increase from 11 to 13 percent (figure 27). However, by 2018, 40 percent will require at least some postsecondary education and training. One-quarter will be in the postsecondary middle-skills job market; however, jobs requiring a high school diploma or less than high school will make up a notable 60 percent of the career cluster.

Figure 27. More than one-third of jobs in Hospitality and Tourism will require postsecondary education and training by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Education requirements for most workers are low compared to other career clusters due to the high volume of entry-level positions and the emphasis on on-the-job training. Many cleaning service workers, who make up the majority of workers in hotel and lodging services, have a high school diploma. Similarly, serving workers, who make up a large portion of food services, are hired based on job experience in the industry and not by educational attainment.

The most experienced waiters and waitresses typically work in fine-dining establishments, where they are able to increase their salaries through more abundant tips. Waiters and waitresses with a high school diploma make close to \$18,000 on average, whereas bartenders with the same level of education make \$20,000 (table 52). Almost one-half of maids and housekeeping cleaners have not completed high school and make little more than \$11,000. These entry-level workers receive on-the-job training to learn company standards and customer-service expectations.

Table 52. Food service managers can earn the highest wages in Hospitality and Tourism at all levels of educational attainment.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Food service managers	30,200	33,900	38,400	41,300	51,600	54,600
Self-enrichment education teachers	—	29,000	29,600	32,000	29,600	34,700
First-line supervisors/managers of food preparation and serving workers	22,900	25,500	28,600	31,100	39,100	—
Cooks, fast food	17,300	17,900	17,900	20,000	22,600	—
Food preparation workers	15,300	15,300	15,300	15,600	16,100	—
Bartenders	17,300	20,000	22,200	23,200	25,500	—
Combined food preparation and serving workers, including fast food	15,200	16,100	15,900	17,300	18,500	—
Counter attendants, cafeteria, food concession, and coffee shop	15,300	13,400	15,400	15,700	16,000	—
Waiters and waitresses	15,800	17,500	18,700	19,000	22,100	—
Dining room and cafeteria attendants and bartender helpers	15,000	14,500	16,700	15,400	16,600	—
Dishwashers	15,000	13,700	13,200	—	—	—
Hosts and hostesses, restaurant, lounge, and coffee shop	13,100	15,800	16,300	15,900	18,200	—
First-line supervisors/managers of housekeeping and janitorial workers	23,900	30,000	35,600	34,100	43,400	—
Janitors and cleaners, except maids and housekeeping cleaners	19,000	23,300	26,200	27,500	24,300	—
Maids and housekeeping cleaners	11,500	12,500	11,600	12,200	11,200	—
Amusement and recreation attendants	19,600	21,500	20,900	22,300	28,700	—
Hotel, motel, and resort desk clerks	17,500	19,800	20,500	22,300	23,100	—

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

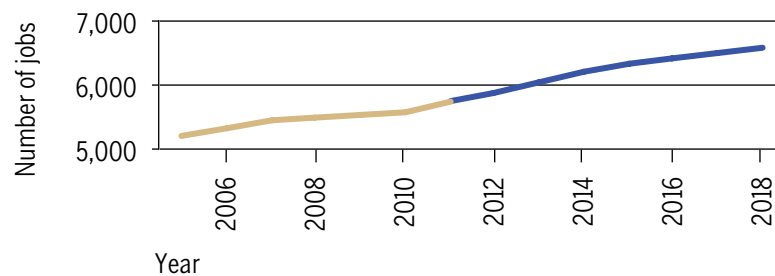
Although willingness to take on additional responsibilities is the most common way to advance in this career cluster, a postsecondary degree is increasingly becoming favored over experience alone for managers. For example, food service managers with a Bachelor's degree (20%) make \$18,000 more than those with only a high school diploma (30%). A variety of universities, colleges, and technical institutes offer programs to prepare managers in hotel and lodging services and food service management. For some positions, including transportation attendants, travel agents, and interpreters, a Bachelor's degree is becoming standard for workers beginning a career in hotel and lodging services.

This career cluster also has licensing requirements: for example, gaming service workers are required to be licensed by the state's regulatory agency. Tour guides in certain municipalities (e.g., Washington, DC) are required to pass a historical examination. Umpires, referees, and other sports officials are expected to demonstrate their understanding of the game by possessing a current state license.

Career Cluster 10: Human Services

Occupations in Human Services are projected to grow by 19 percent between 2008 and 2018 (figure 28). This is one of the few career clusters that weathered the recession and came out relatively unscathed; it continued to add jobs, albeit at a slightly slower pace in 2008 and 2009. Job growth is expected to peak at a 3 percent in 2012 and maintain steady 1 to 2 percent growth per year from 2013 through 2018. By 2018, 69 percent of jobs will require at least some postsecondary education (table 53).

Figure 28. Jobs in Human Services are projected to grow by 19 percent by 2018. This is one of few career clusters that added jobs during the recession.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 53. Many jobs in Human Services require a Bachelor's degree.^a

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^b (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Property, real estate, and community association managers	5	21	27	9	29	9	100
Social workers	1	6	11	6	45	31	100
Miscellaneous community and social service specialists	3	15	21	10	39	13	100
Loan counselors and officers	1	15	26	10	39	8	100
Social and community service managers	1	8	14	7	40	29	100
Substance abuse and behavioral disorder counselors	1	7	11	6	28	47	100
Child, family, and school social workers	1	6	10	6	45	31	100
Clergy	2	7	11	5	28	47	100
Massage therapists	2	18	36	15	23	7	100
First-line supervisors/managers of personal service workers	6	31	29	10	19	5	100
Hairdressers, hairstylists, and cosmetologists	7	46	31	10	5	2	100
Manicurists and pedicurists	20	39	23	8	9	2	100
Child care workers	14	34	28	9	13	2	100
Personal and home care aides	20	37	25	8	8	2	100
Fitness trainers and aerobics instructors	3	18	24	10	36	9	100
Personal care and service workers, all other	12	32	28	7	18	4	100
Laundry and dry-cleaning workers	36	42	13	3	5	1	100
Pressers, textile, garment, and related materials	48	38	8	3	2	1	100

^a Some of the decrease in public human service employment may be picked up by nonprofit organizations that pay lower wages but are partially funded by government and private sources.

^b Some college includes postsecondary vocational certificates.

Forecasting Demand Cluster by Cluster Through 2018

²² According to the U.S. Census Bureau, projected number and share of U.S. Population for 65+, Middle Series: 2000: 35,322,000 (12.8%); 2010: 40,104,000 (13.3%); and 2020: 53,348,000 (16.4%).

The recession has forced federal, state, and local governments to consider budget cuts in many traditional human services. Budget tightening could keep job growth in the public sector lower than it would be otherwise. Despite budgetary pressures, several trends are increasing demand. Population growth will affect the number of job openings; so will the increasing need for services to accommodate baby boomers. The increasing social acceptance of seeking mental health services and the growing importance of education-focused childcare will also increase demand. Moreover, even though budget cuts will affect the career cluster, more than 20 percent of workers are self-employed. Some of the decrease in public-sector employment may be tempered by nonprofit organizations, which offer lower wages due to their often limited funding from government and private sources.

SOCIAL SERVICES

Career opportunities for social workers and related occupations are expected to exceed the national average for job growth between 2008 and 2018. For example, job growth for managers in social and community service is projected to be between 14 and 19 percent. Job growth for social and human service assistants is expected to exceed 20 percent; private social-service agencies will require more of these workers due to increased reliance on contracts from state and local governments.

America's aging population is a major cause for job growth in the Human Services occupations.²² Social workers specializing in the elderly will be needed to help their clients secure quality care and assistance.

Job opportunities for medical and public health social workers will increase by more than 20 percent between 2008 and 2018. Jobs for mental health counselors may increase by 20 percent during the coming decade as Americans become more open to and accepting of mental health services and insurance providers seek affordable mental healthcare options for clients. Because state and local governments are the largest service providers, projected budget cuts will keep growth down to around the national average. Jobs for social workers in education institutions will be increasingly needed (12%) to support a growing student population, especially for the increasing number of students with special needs.

Developments in the judicial system are expected to provide significant job growth for substance abuse and behavioral disorder counselors and social workers specializing in substance abuse. Prison and parole sentences for drug and related cases are expected to include treatment and prevention

counseling. Jobs for substance abuse and behavioral disorder counselors will grow by more than 20 percent by 2018.

Similar to the role of a social worker, loan counselors will be needed to assist people making difficult financial decisions. Job prospects for loan counselors are expected to grow by 14 to 19 percent.

PERSONAL CARE

High costs for hospital and assisted-care facilities for the elderly are expected to create openings for personal- and home-care aides, fitness trainers, and aerobics instructors. Jobs for these workers are projected to increase by at least 20 percent. Though younger people have a higher likelihood of seeking the health benefits of massage therapy, increasing demand from older people will result in much of the 14 to 19 percent increase in job opportunities for massage therapists.

Older people are also expected to require more hair- and skin-care services. Jobs for hairdressers, hairstylists, cosmetologists, and skin-care specialists are expected to grow by 20 percent to keep up with increasing demand for hair coloring and wrinkle-reducing treatments. Job growth for workers providing these services will primarily be located in urban areas.

Personal-care professionals who work for funeral services will be in more demand between 2008 and 2018 because many will be needed to replace retirees. Employment for funeral directors is expected to keep up with national average growth. Jobs for funeral attendants are projected to increase by 20 percent; whereas job growth for embalmers is expected to be slightly below average.

Apparel processing services is the only area in this career cluster not keeping up with national growth. Job opportunities for pressers, textile, garment, and related materials are expected to decline between 3 and 9 percent due to international competition in fabric development and processing. Career prospects for tailors, dressmakers, and custom sewers will show little or no growth as companies increasingly manufacture ready-to-wear clothing. Work will primarily go to the self-employed or those who work in or are associated with a higher-end retail shop. Job growth for laundry and dry-cleaning workers will be limited to 3 to 6 percent due to competition from new products and fabrics that reduce stains and wrinkles. Jobs for first-line supervisors/managers of personal service workers who offer a variety of services for the public are expected to grow by 14 to 19 percent.

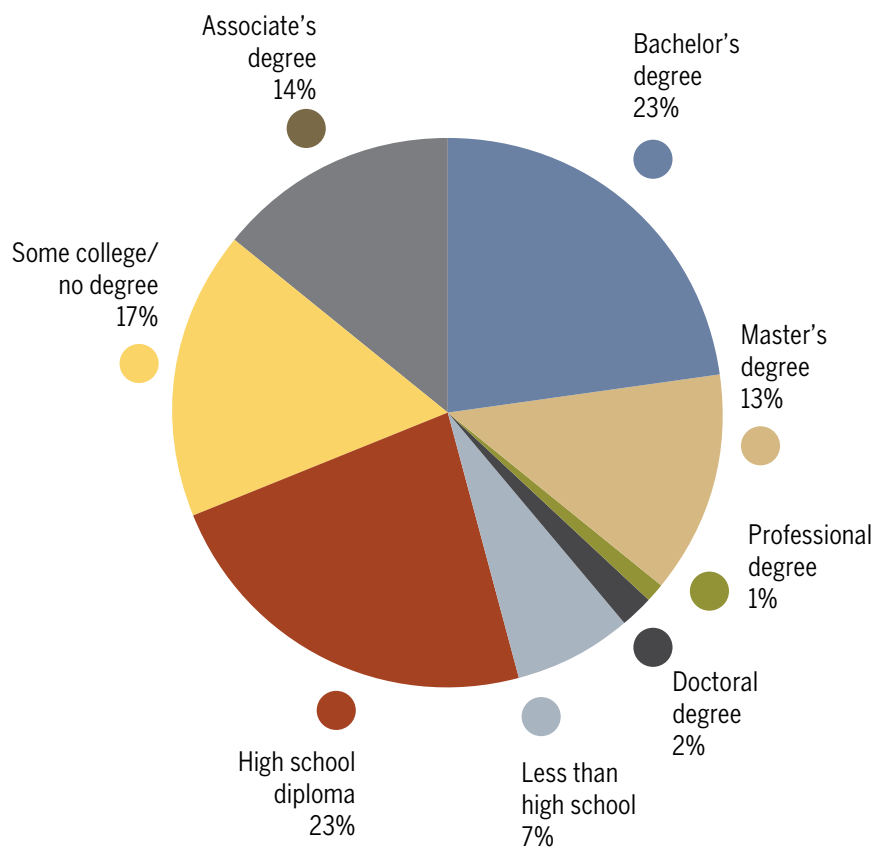
RELIGIOUS SERVICES

Average growth is predicted for clergy and directors of religious activities and education, who may serve similar roles in society as counselors and social workers. Job openings for clergy, directors of religious activities and education, and all other religious workers are expected to grow by between 7 to 13 percent.

EDUCATION DISTRIBUTION OF HUMAN SERVICES OCCUPATIONS

Between 2008 and 2018, the percentage of jobs requiring a Bachelor's degree will increase from 20 to 23 percent (figure 29). Moreover, by 2018, 69 percent will require at least some postsecondary education. By 2018, nearly one-third will be in the postsecondary middle-skills job market and require some college/no degree, a postsecondary vocational certificate, an Associate's degree, or a state-mandated license or certification.

Figure 29. More than two-thirds of jobs in Human Services will require postsecondary education by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Few occupations in the career cluster have strict education and licensing requirements and therefore show a wide range of education levels and wages for each occupation. For counselors, however, most states require advanced education and a license. Almost one-half of substance abuse and behavioral disorder counselors hold a Master's degree and earn an average salary of \$46,000, \$8,000 more than their counterparts with a Bachelor's degree (table 54).

Table 54. Property, real estate, and community association managers can earn the highest wages in Human Services at all levels of educational attainment.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Property, real estate, and community association managers	30,200	40,100	45,200	43,900	69,600	93,100
Social workers	—	29,000	31,400	32,900	35,000	44,500
Miscellaneous community and social service specialists	16,800	25,500	27,400	29,900	38,300	45,700
Loan counselors and officers	—	37,300	41,400	41,000	54,800	72,000
Social and community service managers	—	39,000	44,400	42,200	53,100	67,300
Substance abuse and behavioral disorder counselors	—	29,500	30,200	32,000	34,600	44,800
Child, family, and school social workers	—	31,300	33,600	35,600	37,500	45,600
Clergy	—	31,800	34,900	32,900	38,100	45,800
Massage therapists	—	13,800	13,800	13,300	13,500	11,600
First-line supervisors/managers of personal service workers	18,000	23,200	27,100	26,400	41,800	46,700
Hairdressers, hairstylists, and cosmetologists	13,800	15,400	15,500	16,200	21,200	—
Manicurists and pedicurists	14,400	15,000	15,200	17,200	17,100	—
Child care workers	7,300	9,300	9,700	10,400	12,600	—
Personal and home care aides	13,200	15,700	16,500	17,600	18,700	—
Fitness trainers and aerobics instructors	19,700	21,000	21,200	21,700	25,100	25,500
Personal care and service workers, all other	15,600	18,700	17,900	19,000	21,500	28,500
Laundry and dry-cleaning workers	17,500	19,300	21,900	18,200	24,200	—
Pressers, textile, garment, and related materials	16,200	20,700	18,700	20,400	—	—

^a Some college includes postsecondary vocational certificates.
 — Cell data suppressed due to small sample size.

Forecasting Demand Cluster by Cluster Through 2018

²³Information technology and computing careers have traditionally been grouped together as part of the STEM workforce. The CTE career clusters give Information technology its own subdivision, which reflects its growing importance as a stand-alone factor influencing every facet of industry and occupational requirements.

Most states require massage therapists to complete a training program and acquire a license; 36 percent have completed some type of college coursework. Despite the state education requirements for massage therapists, workers who have some college/no degree earn \$14,000. Similarly, childcare workers are often required to have a certificate, such as the Child Development Associate credential; these workers with some college/no degree earn only \$10,000, less than one-third the MET.

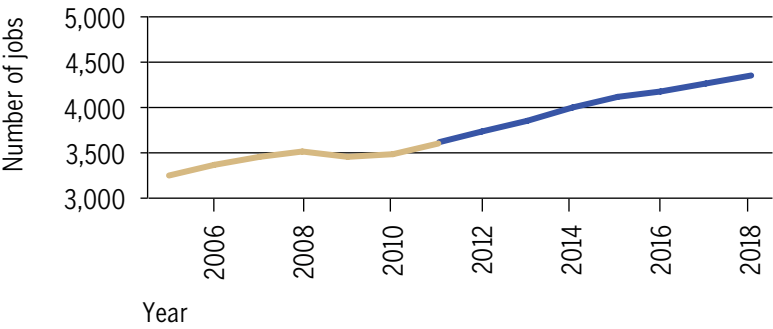
Many low-wage occupations show little variance regardless of educational attainment. More than one-third of laundry and dry-cleaning workers have not completed high school. Workers with a high school diploma (about one-half of the workforce) make \$19,000, or only \$2,000 more than those with less than high school. More than one-third of personal- and home-care aides with a high school diploma earn \$16,000, only \$3,000 more than their counterparts with less than high school. More than one-half of hairdressers, hairstylists, and cosmetologists with high school diplomas earn \$15,000; their wages do not increase even if they have completed some college coursework.

Some workers in this career cluster do earn a relatively high wage: substance abuse and behavioral disorder counselors with a Master's degree or better earn \$46,000. Nearly one-third of clergy have obtained a Bachelor's degree, and consequently earn \$38,000 on average; the almost one-half with a Master's degree earn \$46,000. Property, real estate, and community association managers are fairly evenly split between workers with a high school diploma (\$40,000) and some college/no degree (\$45,000). Workers with a Bachelor's degree earn nearly double the salary (\$70,000).

Career Cluster II: Information Technology

Jobs in Information Technology are projected to grow by 23 percent between 2008 and 2018 (figure 30). It is the fastest growing career cluster but the fourth smallest, with an estimated 3.6 million jobs in 2011.²³ By 2018, 93 percent of jobs will go to workers with at least some postsecondary education and training (table 55).

Figure 30. Jobs in Information Technology are projected to grow by 23 percent between 2008 and 2018, demonstrating the career cluster's influence on every facet of industry and job requirements.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 55. Many jobs in Information Technology require middle skills or a Bachelor's degree.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Computer and information systems managers	1	4	15	9	47	23	100
Computer programmers	1	5	14	10	52	19	100
Computer software engineers, applications	0	2	9	5	51	32	100
Computer support specialists	1	12	29	16	34	7	100
Database administrators	0	5	17	9	48	21	100
Network and computer systems administrators	1	8	25	16	40	10	100
Network systems and data communications analysts	1	8	22	13	44	13	100

^a Some college includes postsecondary vocational certificates.

The Internet has revolutionized the way consumers and businesses relate to the economy, and this career cluster has ushered in these changes. Information technology is driving the innovation that has revolutionized the workplace in the last quarter of a century. In the 19th and 20th centuries, electricity and the internal combustion engine drove the rise of manufacturing and America's shift away from an agrarian economy. Today, computers and related inventions are driving the information revolution, transforming the U.S. economic landscape once again. Just as building a mass K-12 education system was essential for producing workers capable of carrying out the industrial revolution, the information revolution is demanding the building of a mass postsecondary system to meet the needs of sophisticated new and rapidly changing industries, such as computer systems design or financial services.

Information technology has managed to touch nearly every aspect of life. For example, initiatives in Health Science seek to improve coordination of care with electronic health records. IT professionals design the protocol for these records and ensure their security and usability. The global spread of

mobile phones provides evolving opportunities for workers to link service providers to consumers in new markets. This career cluster continues to revolutionize finance and banking, allowing for easier exchange and changing the way people purchase and consume goods.

Not only has technology changed the way people consume, it has also dramatically changed the workplace. New computer programs have increased efficiency and productivity in nearly all industries: engineers in manufacturing can design and test new products in a fraction of the time previously required and instantly program their designs into automated assembly lines, thus keeping production up to date with market trends.

The career cluster has shaped, and continues to shape, in countless ways staffing and employment patterns favoring more skilled workers. Two competing trends will decrease and increase the demand for skills during the next decade. On the one hand, information technology jobs that require limited technical skill, local knowledge, or innovation are liable to be outsourced overseas because computer programming is not place-specific and transportation costs are close to zero. However, the impending retirement of baby boomers guarantees a significant amount of job openings, at least temporarily, for qualified workers. Close to 40 percent of workers were between 45 and 63 years of age in 2009. Career opportunities will be best for workers with experience in information protection and security, as sensitive information (bank records, health records, and corporate and national secrets) increasingly shifts online and needs to be protected.

Information technology has been relatively sheltered from the worst of the recession, although it did experience some decline. During the recession, unemployment in the career cluster jumped from 6 to 8.4 percent between 2009 and 2010. However, for prime age workers (25–54), the unemployment rate dropped from 5.1 in 2009 to 4.5 percent in 2010 and is 4 percentage points lower than the national unemployment rate.

ADMINISTRATORS AND ANALYSTS

More administrators and analysts will be needed as companies begin or increase investing in high-technology systems, programs, and databases. Career opportunities for network and computer systems administrators will grow by 23 percent to help companies maintain efficient and secure systems. Outstanding growth is anticipated for network systems and data communications analysts: a remarkable 53 percent more will be needed to develop websites and integrate telecommunications technology with computer systems and perform other functions.

Jobs for computer systems analysts are expected to grow by 20 percent, as knowledgeable analysts provide systems development and integration to address security needs. Jobs for database administrators will increase by 20 percent to keep up with data storage, organization, and analysis needs. Jobs for computer support specialists will increase by 14 percent to resolve computer issues. Job prospects for computer and information systems managers are projected to increase 17 percent, but these positions will only be available to workers with both technical knowledge and management skills and training.

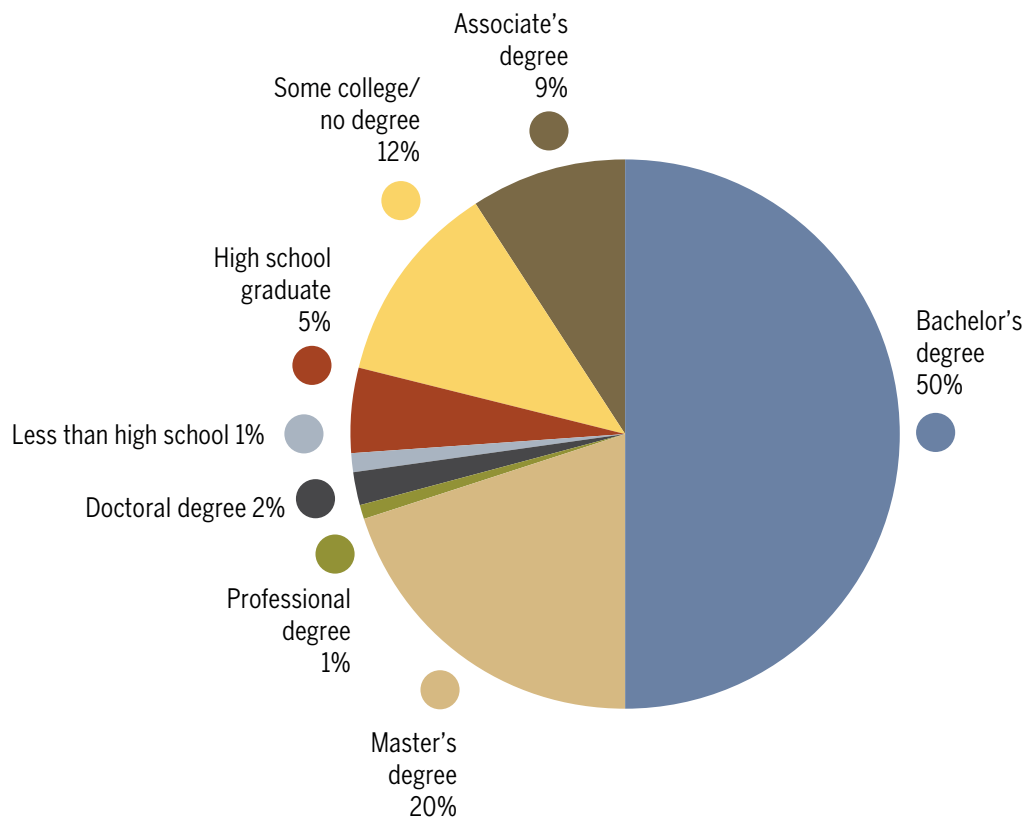
PROGRAMMERS AND COMPUTER ENGINEERS

Computer software engineers will lead the way in developing new and emerging uses for technology. Job opportunities for computer applications software engineers are predicted to grow by 34 percent by 2018 to keep pace with increasing demand for customized applications. Similarly, jobs in computer systems software engineering are expected to grow by 30 percent. Software engineering jobs require significant understanding of market trends to create well-researched and innovative products, making these engineering jobs far less likely to be sent overseas. Job opportunities will remain onshore for workers with highly developed technical skills and specialized understanding of their employer's needs.

EDUCATION DISTRIBUTION OF INFORMATION TECHNOLOGY JOBS

Between 2008 and 2018, the proportion of jobs requiring a Bachelor's degree will increase from 49 to 50 percent (figure 31). Twenty percent will require a Master's degree, and 2 percent will require a doctoral degree by 2018. By 2018, 72 percent will require a Bachelor's degree or better. Although clearly dominated by workers with a Bachelor's degree, the postsecondary middle-skills job market will still make up 21 percent of all jobs by 2018. Jobs for workers with a high school diploma or less than high school will be scarce — a mere 6 percent of all jobs.

Figure 31. More than 70 percent of jobs in Information Technology will require a Bachelor's degree or better by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Information Technology is the career cluster with the greatest emphasis for workers to continually upgrade and upskill as a prerequisite for remaining competitive in the industry. Some workers demonstrate competency by dedicating many years to working with a particular product; whereas others prove their mastery by obtaining certifications administered by software or hardware companies. A separate analysis reveals that Information Technology will require about 600,000 certificates by 2018, although these certificates are often combined with other degrees and credentials.

Professionals looking to work in career clusters such as Business, Management, and Administration or Finance are expected to possess some specialized coursework or professional experience. As a result, computer

Forecasting Demand Cluster by Cluster Through 2018

and information systems managers must acquire administrative skills in addition to a strong technical background.

Some positions are available for workers at the pre-baccalaureate level, although most require at least a Bachelor's degree in a related field. More than one-quarter of computer support specialists and network and computer systems administrators have completed some college courses. Whereas computer support specialists with some college/no degree earn \$50,000, network and computer systems administrators with similar education earn \$63,000 on average (table 56). Close to one-half of computer and information systems managers and computer software engineers obtain their Bachelor's degree, and earn \$98,000 as a result. Workers in these categories can earn significantly more if they obtain their graduate degree, as over one-quarter do. Computer software engineers can earn \$9,000 more with a Master's degree, \$94,000.

Table 56. Workers with only a high school diploma in Information Technology can easily earn wages above the MET.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Computer and information systems managers	—	70,400	80,700	79,200	97,700	113,700
Computer programmers	—	56,200	66,500	64,600	73,000	82,700
Computer software engineers, applications	—	—	78,200	74,000	85,400	94,100
Computer support specialists	—	48,200	50,200	49,900	58,900	67,200
Database administrators	—	50,900	62,200	62,300	75,400	83,600
Network and computer systems administrators	—	58,500	62,500	60,100	69,400	81,500
Network systems and data communications analysts	—	52,600	57,700	57,500	62,500	75,300

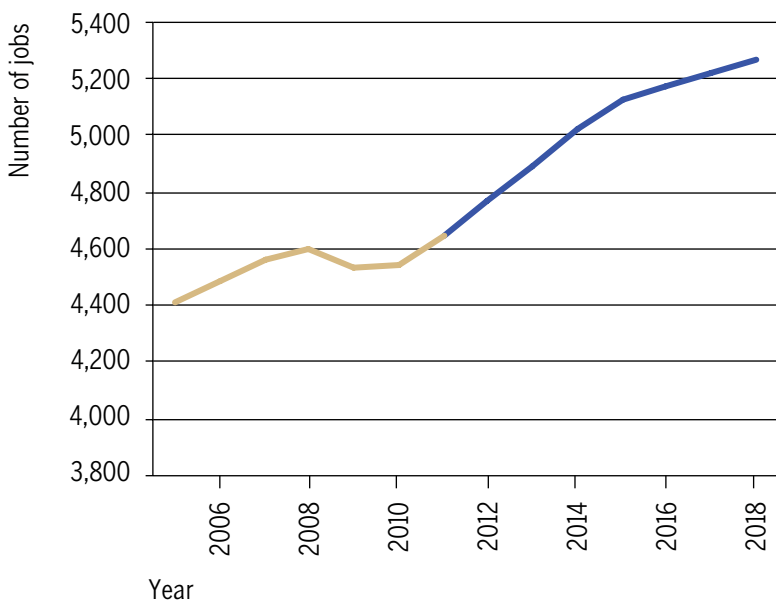
^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

Career Cluster 12: Law, Public Safety, Corrections, and Security

Law, Public Safety, Corrections, and Security occupations are projected to grow by 14 percent between 2008 and 2018 (figure 32). By 2018, 83 percent of jobs will require at least some postsecondary education and training (table 57).

Figure 32. Jobs in Law, Public Safety, Corrections, and Security are projected to grow by 14 percent between 2008 and 2018, but the career cluster will face the same budget constraints affecting local and state governments.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 57. Many jobs in Law, Public Safety, Corrections, and Security require a high school diploma or middle skills.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Probation officers and correctional treatment specialists	2	14	20	10	40	14	100
Lawyers	0	0	1	0	3	96	100
Paralegals and legal assistants	1	12	25	20	36	7	100
Law clerks	2	18	27	14	29	10	100
Emergency medical technicians and paramedics	1	17	47	20	13	2	100
First-line supervisors/managers of correctional officers	2	26	34	14	19	5	100
First-line supervisors/managers of police and detectives	1	14	31	15	30	10	100
First-line supervisors/managers of firefighting and prevention workers	1	17	38	23	18	3	100
First-line supervisors/managers, protective service workers, all other	3	22	33	13	22	8	100
Fire fighters	1	20	41	20	16	2	100
Correctional officers and jailers	2	35	38	13	11	1	100
Police and sheriff's patrol officers	1	15	34	17	28	5	100
Private detectives and investigators	1	14	23	11	40	11	100
Security guards	9	36	31	10	12	2	100
Crossing guards	17	49	23	7	3	1	100
Lifeguards, ski patrol, and other recreational protective service workers	8	29	25	10	24	4	100
Police, fire, and ambulance dispatchers	6	37	36	11	10	1	100

^a Some college includes postsecondary vocational certificates.

As states and communities throughout the nation grapple with widening budget deficits and prepare to make substantial budget cuts, even essential services such as public safety will be put under the knife. Layoffs are often a last resort, but an option nonetheless, especially because many public safety and corrections officials are employed by the cities and states that have been hurting the most during the recession.

The steepest job decline occurred in 2009, as the career cluster dropped from 4.6 to 4.5 million jobs. The next year was also stagnant, with no growth in employment opportunities nationwide. Job growth is expected to peak at a 3 percent in 2012 and maintain this pace through 2014 before declining slightly to an average of 1 percent through 2018.

LAW AND MEDIATION

Career opportunities for lawyers are expected to grow by 13 percent between 2008 and 2018, slightly above the national average. The need for legal services will keep pace with population growth and business activity, a reflection of increases in legal transactions, civil disputes, and criminal cases. Job opportunities will be most favorable in large law firms, the public sector, and law clinics that provide communities with affordable legal assistance. Law professionals who specialize in real estate, bankruptcy, medical malpractice, and product liability will see the most growth, although intellectual property law, corporate and security litigation, antitrust law, and environmental law will also be in demand.

High legal fees will cause businesses to reduce costs by hiring permanent legal staff and avoid litigation by hiring arbitrators, mediators, and conciliators. Jobs for these workers are expected to increase 14 percent.

Overall employment growth for lawyers will be limited somewhat due to an increasing trend among large corporations and large law firms to boost efficiency and cut costs by delegating as much work as possible to large accounting firms and paralegals. In part, this trend is caused by growing complexities and increasing specialization in the practice of law. This trend is also largely responsible for the expected 28 percent increase in jobs for paralegals and legal assistants, who will take on additional legal responsibilities.

Many salaried positions for lawyers and paralegals are expected to remain in urban areas where government agencies, law firms, and large corporations are located. Despite favorable employment growth projections, competition is predicted to be high for job-seeking lawyers and paralegals.

Career opportunities for judges, magistrate judges, and magistrates are expected to be limited due to low turnover and budgetary limitations that prevent governments from replacing these jobs. A growing number of these professionals are choosing to retire and practice law in the private sector. Job growth for law clerks and related support workers is predicted to be between 14 and 19 percent to help judges meet their expanding caseloads. (Information about legislators can be found in Government and Public Administration.)

PUBLIC SAFETY

Career opportunities in public safety will meet the needs of a growing and aging population. These jobs will require more advanced technology skills and a higher education level than before. More than 20 percent more emergency management specialists will be needed to develop and implement disaster relief strategies that take into account trends in population growth. This is also true for police, fire, and ambulance dispatchers: jobs for these workers will increase between 14 to 19 percent between 2008 and 2018. Many replacement jobs in public safety for police, fire, and ambulance dispatchers and emergency management specialists will become available due to workers who leave the industry or retire.

Jobs for police and sheriff's patrol officers and first-line supervisors/managers of police and detectives are expected to grow at an average pace to keep up with demand. Reductions in government spending will limit openings for police officers, especially in smaller departments. Openings left by retirees or local police officers seeking more competitive state, federal, or private-sector security jobs have so far allowed departments the flexibility during budget restrictions to freeze hiring instead of laying off staff.

Nationwide, the urbanization of 50- to 60-year-old empty nesters, workers marrying later in life, and echo boomers is predicted to overwhelm fire departments, which rely on volunteers for more than one-half of their crews. Increased local and state funds will be allocated to fire departments and lead to 19 percent job growth. These openings are likely to attract competition, especially from volunteer firefighters who have committed to extensive training. On the other hand, job growth for fire inspectors and investigators and first-line supervisors/managers of fire fighting and prevention workers is expected to be average.

Services employing emergency medical technicians (EMTs) and paramedics are experiencing difficulties in recruiting volunteers. Although job growth

for these workers is predicted to be on the low side at 9 percent, many opportunities are expected to open when workers leave the industry or seek opportunities for advancement. Demand for these occupations will primarily come from the increasing use of hospital emergency facilities to treat an aging population.

Other notable public safety professionals are predicted to experience varying levels of job growth. New developments in processes and technology in forensic science are predicted to increase demand for forensic science technician services; job growth for these workers is predicted to be 20 percent. Parking enforcement workers, however, are projected to see little or no job growth due to the prevalence of automated parking enforcement systems and more advanced technology. Corporations, parents, and Internet users are the driving forces for job growth as they discover and protect against such security concerns as identity and intellectual property theft. Jobs for qualified private detective and investigators will be highly competitive, although workers who specialize in computer forensic investigation will be most in demand.

CORRECTIONS

Government budgetary concerns will strongly affect job growth in the corrections industry. Mandatory prison sentencing will continue to strain state and local budgets due to an increasing number of incarcerations and a decreasing number of paroles. If sentencing trends move toward less costly rehabilitation and probation, job opportunities for probation officers, correctional treatment specialists, related protective service workers, and social workers are likely to grow.

Current projections anticipate 19 percent job growth for probation officers and correctional treatment specialists. Job growth for correctional officers and jailers, along with corresponding first-line supervisors/managers of correctional officers, is expected to increase by 9 percent. Favorable job opportunities are nevertheless anticipated for corrections officers; many replacement jobs will become available due to workers who leave the industry or retire. Jobs for correctional officers and jailers are concentrated in rural areas, where most prison facilities are located. On the other hand, jobs for probation officers and correctional treatment specialists are more heavily concentrated in urban areas.

SECURITY

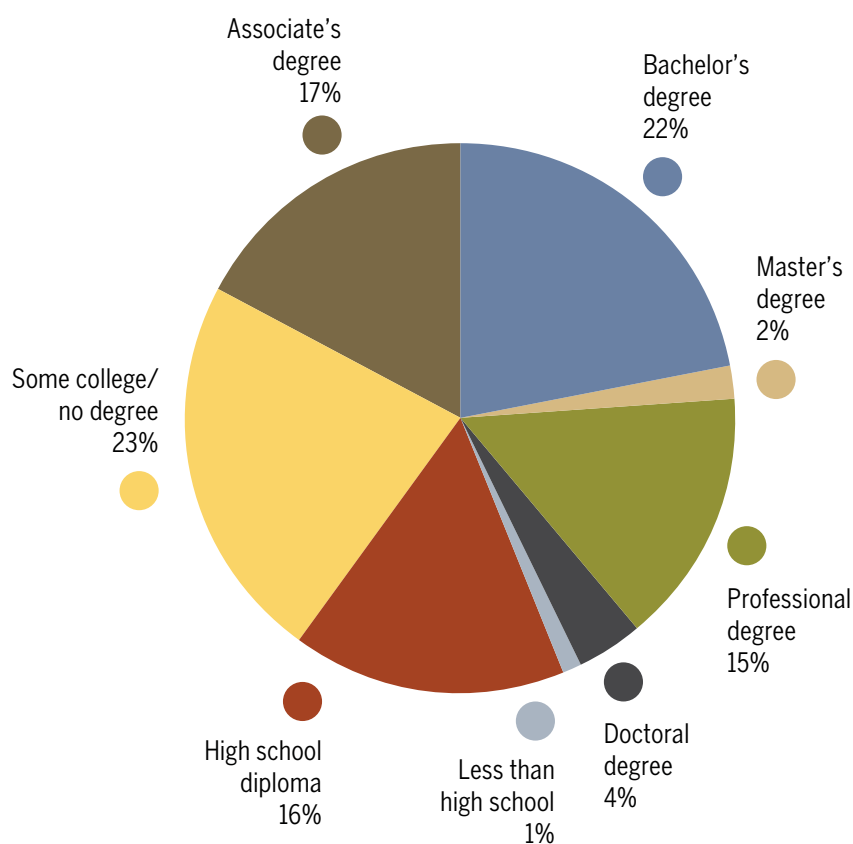
Security guards and related professionals will be hired to protect against perceived security threats and replace workers who regularly leave the industry. Demand will increase for private security guards at hospitals,

nursing homes, and public events traditionally handled by police officers. Jobs for security guards are likely to grow by 14 percent between 2008 and 2018. Similarly, job growth for gaming surveillance officers and gaming investigators is expected to be 12 percent to provide additional support and staff for casinos and new gaming establishments.

EDUCATION DISTRIBUTION OF LAW, PUBLIC SAFETY, CORRECTIONS, AND SECURITY OCCUPATIONS

Between 2008 and 2018, the share of Law, Public Safety, Corrections, and Security jobs requiring a Bachelor's degree will increase from 18 to 22 percent (figure 33). Moreover, 83 percent will require at least some postsecondary education and training by 2018. A large number will require a professional degree (15%) because lawyers have professional degrees. However, 40 percent of jobs will be in the postsecondary middle-skills market by 2018.

Figure 33. More than 80 percent of jobs in Law, Public Safety, Corrections, and Security will require postsecondary education and training by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Many workers in this career cluster are required to obtain licenses and certificates and take training in addition to their formal education. Lawyers must pass a state bar examination in addition to obtaining their professional degree. Correctional officers attend a training academy similar to the one required for most probation officers and correctional treatment specialists. Almost all departments require fire fighters to be certified as EMTs in addition to participating in training programs offered by the U.S. National Fire Academy. Most states require security guards to go through a licensing process. Police, fire, and ambulance dispatchers typically complete on-the-job training.

Many high-wage occupations are available at the postsecondary middle-skills level (table 58). Over three-quarters of police, fire, and ambulance dispatchers have a high school diploma or some college/no degree. Regardless, workers with this education earn more than \$35,000. Similarly, correctional officers and jailers with a high school diploma make \$42,000; with some college/no degree, \$46,000. More than one-half of fire fighters have postsecondary middle skills; with high school graduates earning \$54,000, and workers with an Associate's degree earning \$66,000. Security guards, however, earn only \$30,000 with a high school diploma and do not earn wages above the MET unless they have a Bachelor's degree.

Table 58. Within most Law, Public Safety, Security, and Corrections jobs, workers with higher levels of educational attainment can earn wages higher than the MET.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Probation officers and correctional treatment specialists	—	30,200	32,300	35,000	42,400	52,200
Lawyers	—	—	—	—	86,500	119,500
Paralegals and legal assistants	—	41,600	43,300	42,200	50,200	51,900
Law clerks	—	42,900	42,600	38,600	47,700	69,000
Emergency medical technicians and paramedics	—	41,900	43,900	47,600	54,200	51,400
First-line supervisors/managers of correctional officers	—	47,100	53,800	55,200	58,700	69,600
First-line supervisors/managers of police and detectives	—	53,000	69,200	71,400	82,200	95,900
First-line supervisors/managers of fire fighting and prevention workers	—	64,500	75,400	81,200	86,600	102,600
First-line supervisors/managers, protective service workers, all other	33,400	38,800	46,900	47,300	63,300	81,400
Fire fighters	—	54,400	61,200	66,300	66,400	—
Correctional officers and jailers	—	42,100	45,900	47,900	48,500	—
Police and sheriff's patrol officers	—	51,600	57,900	60,700	65,900	77,700
Private detectives and investigators	—	38,900	47,100	47,300	56,700	66,200
Security guards	24,400	29,800	33,600	34,900	42,800	—
Crossing guards	14,800	16,100	17,700	15,300	14,200	—
Lifeguards, ski patrol, and other recreational protective service workers	16,500	19,700	25,900	26,900	34,300	37,600
Police, fire, and ambulance dispatchers	31,200	35,600	38,300	38,000	43,000	—

^a Some college includes postsecondary vocational certificates.

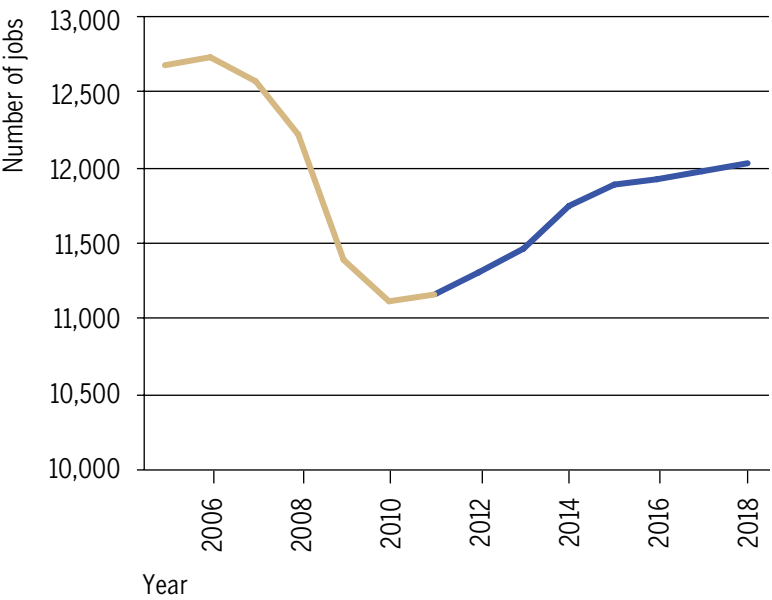
— Cell data suppressed due to small sample size.

Many occupations in this career cluster have high education requirements. Lawyers with a doctoral degree earn \$119,000 on average. Close to one-third of law clerks hold a Bachelor's degree, earning \$48,000 on average. Almost one-half of probation officers and correctional treatment specialists hold a Bachelor's degree, earning \$43,000. Whereas police and sheriff's patrol officers with a Bachelor's degree earn \$66,000, their counterparts with only some college/no degree earn \$58,000.

Career Cluster 13: Manufacturing

Although Manufacturing is poised for recovery, new opportunities will arise mostly from baby boomer retirement, not from new job creation (figure 34). By 2018, 42 percent of jobs, which include maintenance, repair, and inspection, and production and assembly, will go to workers with at least some postsecondary education and training (table 59).

Figure 34. Jobs in Manufacturing will decline in number between 2008 and 2018, but about 2 million jobs will become available as baby boomers retire.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 59. Many jobs in Manufacturing require a high school diploma or middle skills.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Production, planning, and expediting clerks	3	26	30	11	24	6	100
First-line supervisors/managers of mechanics, installers, and repairers	8	38	30	12	10	2	100
Computer, automated teller, and office machine repairers	3	20	32	22	20	3	100
Telecommunications equipment installers and repairers, except line installers	3	31	35	18	11	1	100
Industrial machinery mechanics	11	44	27	12	5	1	100
Maintenance and repair workers, general	14	43	26	11	5	1	100
First-line supervisors/managers of production and operating workers	11	41	25	8	12	3	100
Electrical and electronic equipment assemblers	21	48	18	7	5	1	100
Team assemblers	21	49	20	6	4	1	100
Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	20	55	18	3	2	0	100
Machinists	11	49	27	10	3	1	100
Welders, cutters, solderers, and brazers	23	50	19	5	2	0	100
Sewing machine operators	44	38	10	3	4	1	100
Inspectors, testers, sorters, samplers, and weighers	12	39	25	10	11	3	100
Packaging and filling machine operators and tenders	37	43	13	3	3	1	100
Helpers—production workers	36	41	14	2	5	1	100
Production workers, all other	23	48	19	5	4	1	100

^a Some college includes postsecondary vocational certificates.

Projections show that manufacturing output will grow from roughly \$4 billion in 2008 to \$4.9 billion in 2018, maintaining the industry's position as America's largest industry as measured by contributions to national output. Nationwide, however, after peaking as the leading employer in 1979, the manufacturing industry began to decline. After declining for decades, manufacturing was dealt a severe blow during the recession and lost a significant proportion of jobs. This was especially true for the auto industry, which lost an estimated 300,000 jobs between 2008 and 2009 when plants shut their doors.

Still, roughly 2 million replacement jobs will open due to baby boom retirements. Although manufacturing jobs will decline in number, baby boom retirements are likely to create labor shortages.

Moreover, hiring trends have moved toward more skilled workers with postsecondary credentials. Demand for domestically manufactured products, which are projected to vary by industry, will be met more often by an array of cost-saving and efficiency strategies.

The manufacturing workforce will continue to contract throughout the next decade, steeply at first, with some recovery through 2015. Nationwide, the number of jobs will shrink from 12.2 million by 2008 to 11 million in 2011 and recover to roughly 12 million in 2018. The deepest decline took place in 2009, at the height of job losses during the recession.

Close to 85 percent of manufacturing jobs are concentrated in four industries: manufacturing (64%), wholesale and retail trade (7%), leisure and hospitality services (7%), and professional and business services (6%). Geographically, jobs are highly concentrated in the Midwest.²⁴

²⁴Midwestern reliance on manufacturing employment is just over 17% (down from 39% in the 1960s); employment shares are higher in Indiana (21%), Wisconsin (21%), and Ohio (18%), with Iowa average (17%) and Michigan, surprisingly, well below average (13%).

Manufacturing growth and decline by industry between 2008 and 2018

- Aerospace product and parts manufacturing, -0.3 percent;
- Chemical manufacturing, except drugs, -13.3 percent;
- Computer and electronic product manufacturing, -19.3 percent;
- Food manufacturing, -0.1 percent;
- Machinery manufacturing, -7.6 percent;
- Motor vehicle and parts manufacturing, -16.3 percent;
- Pharmaceutical and medicine manufacturing, 6.1 percent;
- Printing, -16.0 percent;
- Steel manufacturing, -12.7 percent;
- Textile, textile product, and apparel manufacturing, -47.9 percent.

PRODUCTION AND ASSEMBLY JOBS

Employment for production and assembly workers is determined largely by growth and decline in various manufacturing industries. In the steel, textile, and computer industries, strong foreign competition has put pressure on the domestic manufacturing job market. One way Manufacturing is adapting to increasing foreign competition is by transitioning to team production and assembly. Still, job growth for team assemblers, who account for more than one million workers, is projected to be zero between 2008 and 2018.

Career opportunities for welders, cutters, solderers, and brazers are expected to decline by 2 percent as advanced equipment improves worker productivity. Welding work, however, remains nearly impossible to automate; demand for welders is expected to continue, mostly due to their flexibility and versatility.

Job opportunities for machine setters, operators, and tenders; and machine feeders and off-bearers are expected to decline rapidly, for some by more than 10 percent, as technological advances in computer-controlled machinery reduce the need for production and assembly staff. As a result of the same trend, job growth for computer-controlled machine tool operators who make metal and plastic materials will be average between 2008 and 2018. Further, decline in textile manufacturing will lead to decline in demand for textile workers. Jobs for sewing machine operators are expected to decline by a steep 34 percent, slightly less than the projected decline for the textile, textile-product, and apparel-manufacturing industry as a whole.

Job opportunities for mixing and blending machine setters, operators, and tenders, however, are expected to grow by above-average rates due to increased demand in the chemical manufacturing industry, particularly in the pharmaceutical and medicine industry.

INSTALLATION, MAINTENANCE, AND REPAIR JOBS

Demand for general maintenance and repair workers is expected to grow by 11 percent, slightly above the national average, as more workers will be needed to staff a growing number of buildings and factories. Jobs for industrial machinery mechanics are expected to grow by 7 percent, mostly to support an increasingly automated manufacturing industry. Job opportunities for medical equipment repairers will grow at a fast clip (27%) to keep up with the health needs of America's baby boomers. Jobs for telecommunications equipment installers and repairers; and computer, automated teller, and office machine repairers are expected to decline (-4%) due to the extended lifespan and reliability of new equipment; however, jobs for line installers will not decline.

COORDINATION AND INSPECTION JOBS

Jobs for industrial production managers are predicted to decline by 9 percent as worker efficiency and automated assembly lines reduce staffing needs. Job prospects for inspectors, testers, sorters, samplers, and weighers are expected to decline by 4 percent as automated systems replace product-quality checks made by hand. Similarly, jobs for recordkeeping professionals, such as weighers, measurers, checkers, and samplers, will decline by 13 percent for the same reason.

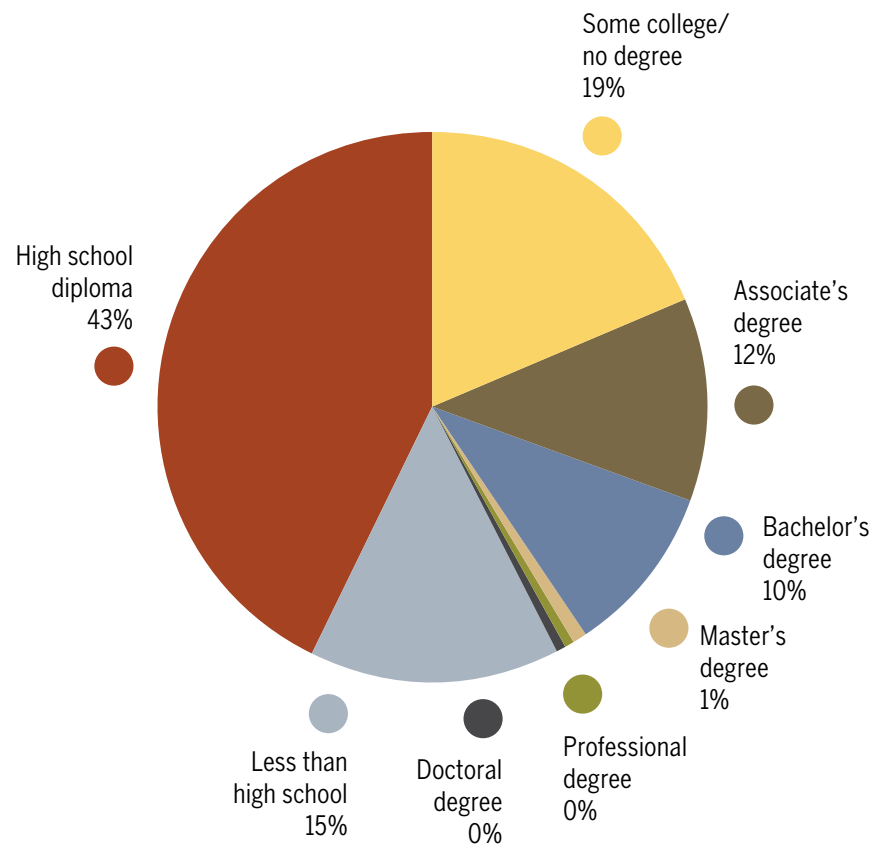
Job opportunities for purchasing agents, except wholesale, retail, and farm products, will grow by 14 percent as manufacturers purchase goods from an increasing variety of suppliers and outsource traditionally in-house services, including distribution, marketing, and information technology support. Jobs for production, planning, and expediting clerks will grow a by a limited but positive 2 percent due to some distribution services remaining in-house.

EDUCATION DISTRIBUTION OF MANUFACTURING JOBS

Between 2008 and 2018, the proportion of manufacturing jobs requiring a Bachelor's degree will increase from 8 to 10 percent (figure 35). Only 1 percent will require a Master's degree by 2018. Although the career cluster is dominated by workers with a high school diploma (43%), a significant one-third of jobs will be in the postsecondary middle-skills market. That is, 31 percent will require a postsecondary vocational certificate, state certification or license, or an Associate's degree by 2018, reflecting the

need for a more skilled workforce as technological advances develop more complex manufacturing processes.

Figure 35. More than 40 percent of jobs in Manufacturing will require postsecondary education by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

International competition has led to an increased focus of resources on efficiency, including the use of highly sophisticated equipment. This equipment reduces the demand for lower skilled workers. Although a high-school diploma may be sufficient for many jobs in Manufacturing, starting a career is increasingly difficult for workers who lack specialized technical training. Workers can, however, demonstrate relevant experience with formal education, certificate programs, and licensing.

A variety of certification courses are offered in a broad range of technical areas. Some organizations offering certificates to manufacturing workers include the American Welding Society, the American Society for Quality, and the Institute for Printed Circuits. Additionally, some manufacturing workers, such as electricians, are required to be licensed according to a state's particular requirements.

New workers are expected to undergo employee training to become familiar with new products, equipment, and company policies. Machinists with an Associate's degree from a community or technical college will still require significant on-the-job training to meet productivity standards and work independently. Although an Associate's degree is encouraged for less technical workers, assemblers of electrical, electronic, aircraft and motor vehicle products are required to have one from a technical school. Industrial production managers and purchasing managers, buyers and purchasing agents with a Master's degree are becoming more prevalent.

Many high-wage jobs are available for workers with only a high school diploma (table 60). Nearly one-half of machinists with a high school diploma earn \$43,000. Similarly welders, cutters, solderers, and brazers earn \$37,000, slightly higher than the MET. Thirty-nine percent of inspectors, testers, sorters, samplers, and weighers hold only a high school diploma and earn the MET of \$35,000.

Table 60. Those who work as supervisors and managers in Manufacturing can earn wages above the MET at all education levels, but their earnings consistently increase along with their educational attainment.

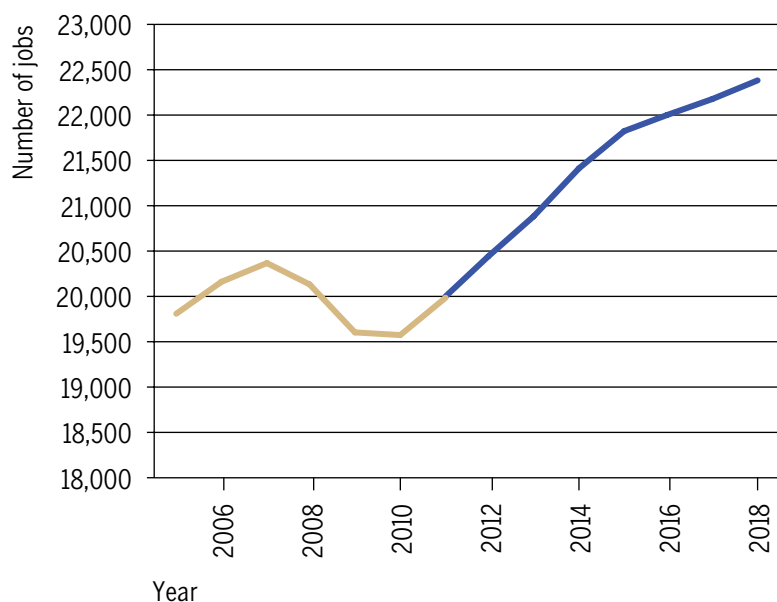
	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Production, planning, and expediting clerks	33,600	39,400	41,800	43,900	52,600	66,700
First-line supervisors/managers of mechanics, installers, and repairers	44,400	53,700	58,200	61,000	68,400	—
Computer, automated teller, and office machine repairers	31,500	38,800	41,900	43,200	45,300	51,600
Telecommunications equipment installers and repairers, except line installers	39,300	50,300	53,500	54,800	52,500	—
Industrial machinery mechanics	36,500	45,500	50,500	51,000	54,500	—
Maintenance and repair workers, general	32,800	40,300	44,300	46,500	47,100	—
First-line supervisors/managers of production and operating workers	37,900	47,600	53,800	56,100	68,800	93,600
Electrical and electronic equipment assemblers	22,800	28,600	30,000	33,100	32,100	—
Team assemblers	23,100	31,500	35,500	34,900	35,000	—
Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	25,800	31,300	33,500	34,400	—	—
Machinists	34,700	42,600	45,300	47,700	47,400	—
Welders, cutters, solderers, and brazers	31,500	36,900	39,900	39,100	37,500	—
Sewing machine operators	17,300	20,200	20,500	18,300	18,000	—
Inspectors, testers, sorters, samplers, and weighers	25,500	35,300	42,000	44,600	48,600	62,000
Packaging and filling machine operators and tenders	19,800	26,000	29,500	26,500	31,900	—
Helpers—production workers	20,500	26,200	31,700	—	24,600	—
Production workers, all other	24,500	33,600	38,000	39,800	42,800	—

^a Some college includes postsecondary vocational certificates.
— Cell data suppressed due to small sample size.

Career Cluster 14: Marketing, Sales, and Service

Marketing, Sales, and Service is the second-largest career cluster and is projected to grow by 11 percent to 22.4 million jobs between 2008 and 2018 (figure 36). By 2018, 59 percent of jobs will require at least some postsecondary education (table 61).

Figure 36. Jobs in Marketing, Sales, and Service are projected to grow by 11 percent between 2008 and 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 61. The education level required for jobs in Marketing, Sales, and Service varies widely.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Wholesale and retail buyers, except farm products	4	24	27	10	31	4	100
Market research analysts	0	4	10	5	51	29	100
First-line supervisors/managers of nonretail sales workers	5	24	24	8	30	8	100
Cashiers, except gaming	18	43	23	6	8	1	100
Counter and rental clerks	14	38	24	8	14	2	100
Retail salespersons	7	31	28	9	22	3	100
Sales representatives, services, all other	3	16	25	9	40	8	100
Sales representatives, wholesale and manufacturing, technical and scientific products	3	18	22	8	42	7	100
Demonstrators and product promoters	12	30	25	9	20	4	100
Real estate brokers	1	15	28	10	37	9	100
Telemarketers	10	34	32	8	14	2	100
Door-to-door sales workers, news and street vendors, and related workers	15	33	26	9	16	3	100
Sales and related workers, all other	3	13	18	7	45	14	100
Customer service representatives	4	29	33	11	19	3	100
Order clerks	9	37	29	9	14	2	100
Office clerks, general	4	32	34	12	15	3	100

^a Some college includes postsecondary vocational certificates.

Students often enter education programs in Marketing, Sales, and Service because of prior or concurrent experience as service workers. Wanting to expand their knowledge, they gravitate toward courses and programs in this career cluster because this education is more prevalent at the postsecondary level.

This career cluster will be strongly affected by mergers and industry consolidation in the coming years. Companies are expected to continue

outsourcing jobs instead of hiring full-time staff. The projected rise in marketing consultancy firms may come at an increasing cost to sales staff, as marketing experts take over more jobs dealing with purchasing.

The deepest decline occurred during the recession; between 2008 and 2009, jobs fell by 3 percent, from 2 to 1.9 million. However, beginning in 2011, the career cluster is expected to rebound and grow steadily through 2014 and more slowly through 2018.

MARKETING

Companies are responding to rising global competition by improving their public image through branding and focusing on consumer trends. Finding innovative and effective ways to promote products and services in a rapidly changing marketplace will spur demand for related workers. Jobs for market research analysts, for example, are expected to grow by 28 percent between 2008 and 2018 due to their ability to target marketing initiatives through observed consumer feedback. Market research analysts are not only expected to report on trends, but also to offer recommendations for new projects and implement promotion strategies. As Internet use grows globally, companies will focus more on Internet-based advertising. Partially as a result, opportunities for telemarketers are projected to decline by 17 percent as more and more people switch from land lines to mobile phones.

SALES

New uses for technology limit job prospects in the wholesale industry in two key areas. Streamlined logistics reduce the need for workers to track the purchasing and distribution of goods. Consequently, jobs for wholesale and retail buyers are expected to show no growth between 2008 and 2018; for parts suppliers, a 1 percent decline; for order clerks, a 26 percent decline. Efficient, internet-based programs allow customers to bypass wholesalers and interact directly with manufacturers.

Wholesale distribution companies offering more customer service. As a result, direct customer interactions will be essential to consumer satisfaction. Job growth for sales representatives, therefore, is expected to keep up with the national average. Another service offered to customers will include private labeling, through which wholesalers arrange with manufacturers to produce goods under a customer's company's name.

Pressures on retail firms are similar to those affecting wholesale companies: the health of the industry is strongly tied to both the health of the economy and to changing consumer preferences. The retail industry is reacting to increased competition by finding different ways to serve the consumer. For

example, companies will diversify by offering increased online shopping options, superstores, outlet stores, and high-end stores. Due to the efficiency allowed by offering online products, jobs for door-to-door sales workers, news and street vendors, and related workers are projected to decline by over 10 percent by 2018.

OTHER SALES

Home sales will gradually increase because demand for real estate is closely tied to economic recovery. Jobs for real estate brokers and sales agents are projected to be better than average: jobs for brokers will grow by 11 percent; for sales agents, by 17 percent.

Job growth for sales engineers is projected to grow by 9 percent, slightly below the national average, because their technological expertise cannot be easily replaced by computer programs. Although many sales engineers work in the declining manufacturing industry, their technological expertise in that industry will not easily be replaced.

SERVICES

Cashiers held 1.7 million jobs and customer service representatives 1.1 million in 2008 and made up the majority of workers in this area. As with marketing and sales, technological advancements in efficiency will limit growth for most jobs. The expanding online shopping market and the expansion of self-service check-out is expected to limit growth for cashiers, as well as counter and rental clerks: job growth for these workers will be a moderate 3 to 6 percent. Reliable automated systems are projected to take over the role of attendants, including parking lot and service station attendants. Jobs for parking lot attendants will grow by 4 percent; for service station attendants by 1 percent.

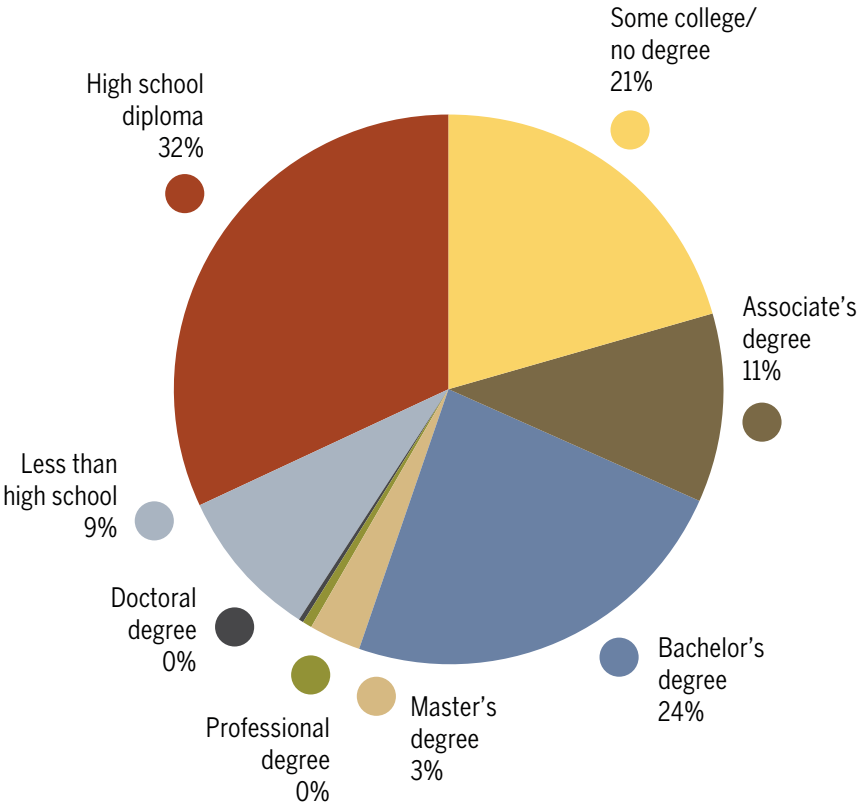
In contrast, jobs for customer service representatives are projected to grow by 18 percent because companies are projected to meet increasing price competition by offering user-friendly support services. Previously outsourced customer service jobs are expected to return to the U.S. due to the importance of reaching the consumer with expertise and cultural sensitivity. Additionally, customer service representatives are less vulnerable to layoffs caused by unstable markets because many of these workers are concentrated in industries, such as banking and healthcare, where customers hold accounts.

EDUCATION DISTRIBUTION OF MARKETING, SALES, AND SERVICE JOBS

Between 2008 and 2018, the proportion of jobs requiring a Bachelor's degree will increase from 22 to 24 percent (figure 37). Moreover, by

2018, 59 percent will require some form of postsecondary education and 3 percent will require a Master's degree. However, one-third of jobs will be in the postsecondary middle-skills market in 2018. Another one-third will go to workers with a high school diploma.

Figure 37. Nearly 60 percent of jobs in Marketing, Sales, and Service will require postsecondary education by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Licenses or certifications in addition to education requirements are rare; however, real estate brokers and sales agents must have state licenses. Many marketing research analysts obtain a Professional Researcher Certification through the Marketing Research Association.

Nearly one-half of marketing research analysts hold a Bachelor's degree; 29 percent, a Master's degree or better. This investment increases the salary for marketing research analysts from \$71,000 to \$98,000 (table 62). Most real estate brokers hold a Bachelor's degree and earn \$20,000 more than their counterparts with some college/no degree.

Table 62. Some workers within Marketing, Sales, and Service, such as sales representatives, surpass the MET even with a high school diploma or less; however, additional education significantly boosts their earnings.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Wholesale and retail buyers, except farm products	31,700	35,200	40,000	43,100	57,300	68,500
Market research analysts	—	55,100	54,100	55,100	71,400	97,700
First-line supervisors/managers of nonretail sales workers	36,600	47,200	56,600	56,000	90,100	123,200
Cashiers, except gaming	16,400	18,200	19,200	20,000	28,400	—
Counter and rental clerks	19,000	23,100	25,300	25,800	39,900	—
Retail salespersons	24,000	29,000	32,300	32,700	49,100	50,400
Sales representatives, services, all other	42,200	49,100	56,500	58,300	89,000	108,400
Sales representatives, wholesale and manufacturing, technical and scientific products	35,100	47,800	57,700	59,900	87,200	100,600
Demonstrators and product promoters	13,300	14,100	16,100	17,100	36,500	24,500
Real estate brokers	—	36,200	37,900	36,500	58,300	61,600
Telemarketers	18,600	20,400	22,000	23,300	36,200	—
Door-to-door sales workers, news and street vendors, and related workers	9,700	14,400	13,200	11,400	18,800	21,200
Sales and related workers, all other	22,600	32,700	42,400	44,500	65,300	75,200
Customer service representatives	23,900	29,200	31,200	32,600	44,000	53,700
Order clerks	23,400	28,500	30,400	29,000	35,500	—
Office clerks, general	23,200	28,500	30,000	30,300	32,800	37,100

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

Many career opportunities are available for workers with postsecondary middle skills. Wholesale and retail buyers with a high school diploma, except for farm products, earn the MET of \$35,000. More than one-third of order clerks work in this field with a high school diploma, earning \$28,000 on average. The nearly one-half of cashiers who hold a high school diploma earn \$18,000, slightly more than one-half the MET.

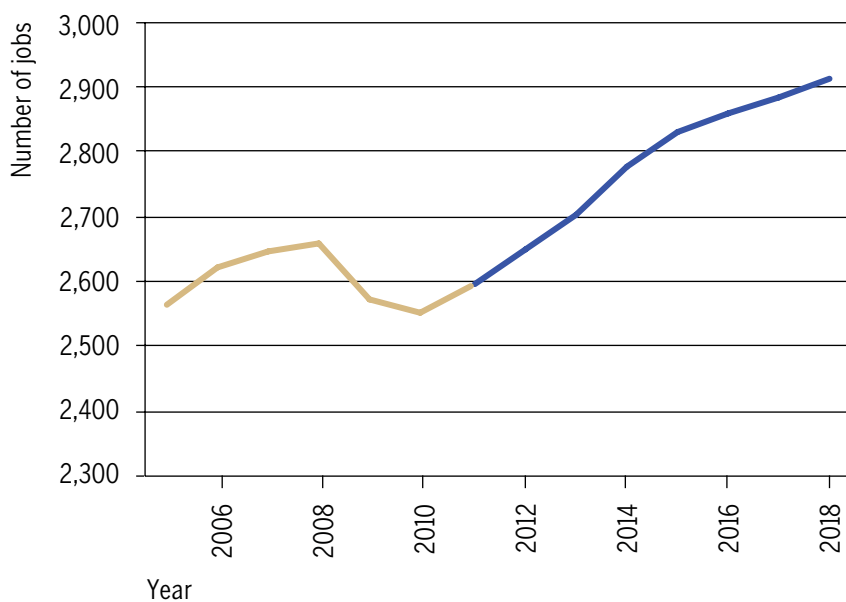
Forecasting Demand Cluster by Cluster Through 2018

²⁵ Compared to traditional definitions from the Bureau of Labor Statistics, computer-related occupations, architects, and social scientists are excluded here.

Career Cluster 15: STEM (Science, Technology, Engineering, and Mathematics)

STEM workers are Engineers, Mathematicians, and Physical Scientists and Physical Scientist Technicians.²⁵ STEM occupations are projected to grow 9 percent between 2008 and 2018 (figure 38). Examples of occupations in this career cluster include electrical and industrial engineers, mathematicians, and biologists. After the steep decline in 2009 during the recession, job growth is expected to be robust going forward from 2011 and taper off slightly in 2016. The education requirements for these jobs are high: the vast majority demand at least some postsecondary degree (table 63). By 2018, 90 percent will go to workers with at least some postsecondary education and training.

Figure 38. Jobs in STEM are projected to grow by 9 percent between 2008 and 2018, and the career cluster is largely responsible for maintaining U.S. competitiveness in the global economy.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 63. Many jobs in STEM require a Bachelor's degree.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Engineering managers	1	4	7	5	47	36	100
Computer and information scientists, research	1	6	16	11	46	20	100
Aerospace engineers	0	3	7	7	51	33	100
Computer hardware engineers	0	6	12	11	42	29	100
Electrical engineers	0	3	8	9	51	28	100
Industrial engineers	0	7	12	10	51	19	100
Mechanical engineers	0	5	9	11	52	22	100
Engineers, all other	0	3	7	8	50	31	100
Architectural and civil drafters	2	12	28	33	21	4	100
Electrical and electronic engineering technicians	3	23	32	24	15	3	100
Surveying and mapping technicians	6	30	37	20	6	1	100
Chemists	0	0	5	3	54	38	100
Environmental scientists and specialists, including health	0	1	3	3	50	43	100
Biological technicians	3	15	16	9	38	19	100
Chemical technicians	4	25	25	13	26	8	100
Life, physical, and social science technicians, all other	2	17	24	12	30	14	100
Technical writers	1	5	13	7	50	24	100

^a Some college includes postsecondary vocational certificates.

ENGINEERS

Engineering is predicted to keep pace with economic growth between 2008 and 2018. Some specializations will grow faster than others, but the growth rate of STEM jobs overall is four percentage points above the national average.

The average increase in employment masks large discrepancies among engineering sub-specialties. Jobs for petroleum engineers will grow 18 percent. Conversely, jobs for chemical engineers are expected to decline

by 2 percent between 2008 and 2018. Whereas industrial engineers are slated to experience 14 percent job growth, electrical engineers will only experience 2 percent job growth.

Employment opportunities for engineers are very much related to the industries in which they are found. Of the jobs held by engineers in 2008, more than one-third were located in manufacturing; another third in the professional, scientific, and technical services industries; and the rest in construction, telecommunications, and wholesale trade industries. Research and development and consulting services show great promise; however, jobs related to design, building, testing, and improving manufactured products show little growth. Projected growth reflects job openings created by an increase in production and replacement jobs for engineers transferring into related positions, such as management and sales, and retirees.

Recent engineering graduates benefit from some of the highest average starting salaries of workers with a Bachelor's degree. Earning potential for engineers varies by specialization. Petroleum engineers have the highest salary potential; health and safety engineers (except mining safety engineers and inspectors) enjoy correspondingly high wages. The high wages paid to petroleum engineers reflects a shortage of trained workers; students sought other careers when new drilling prospects declined domestically in the 1980s.

An immigration policy that favors STEM workers (17 extra months of Optional Practical Training (OPT)) also increases industry access to the pool of well-trained foreign-born engineers; (anecdotally, such engineers are available at a lesser salary).

Although other career clusters have seen new technologies displace workers, engineers in STEM will continue to thrive as they rely on the creative process of producing and analyzing product designs. In fact, these workers will benefit from faster production brought on by new technologies because much of their employment is contingent upon optimizing manufacturing processes.

STEM PHYSICAL SCIENTIST TECHNICIANS

Jobs for surveying and mapping technicians, one of the larger classifications of STEM technicians, will grow by approximately 20 percent by 2018. Job growth for biological technicians will also be rapid at 18 percent between 2008 and 2018. On the other hand, jobs for chemical technicians are expected to decline by 1 percent. Jobs for electrical and

electronic engineering technicians, who constitute slightly more than one-third of all of engineering technicians, are projected to decline by 2 percent. As noted, career growth for biological technicians is linked to expanding production in pharmaceutical and medical manufacturing. Similarly, the declining need for domestic chemical technicians is the result of large chemical manufacturing industries shifting production and operations overseas.

PHYSICAL SCIENTISTS AND MATHEMATICIANS

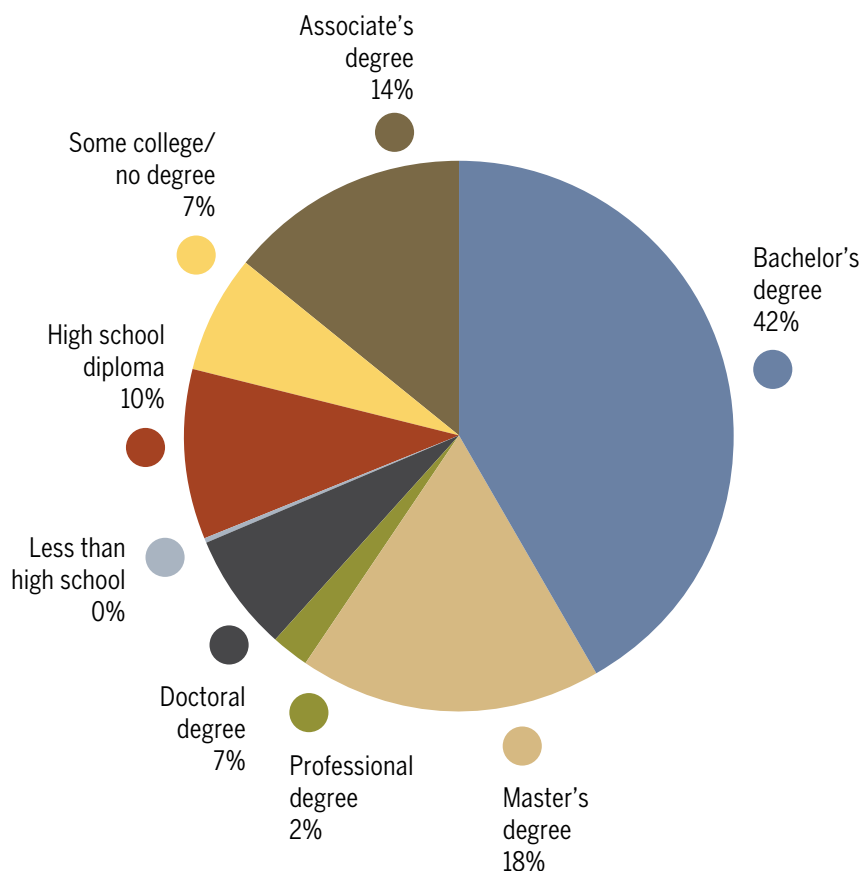
Job growth for mathematicians is projected to be 22 percent; however, these professionals will need to be highly qualified and have experience in related science or engineering fields to compete in a tight job market. The most job growth for physical scientists and mathematicians is found among biochemists and biophysicists, at a rate of 37 percent between 2008 and 2018. Jobs for geoscientists, including hydrologists, will increase by 18 percent; for geographers, by 26 percent. Jobs for chemists, on the other hand, are expected to grow by only 2 percent. This difference in growth is due to very different trends in the labor market.

Biotechnological research and development drives job growth for biologists. On the other hand, domestic jobs for chemists and materials scientists are projected to stagnate due to outsourcing in chemical manufacturing, which employed around 42 percent of chemists and materials scientists in 2008.

EDUCATION DISTRIBUTION OF STEM JOBS

Between 2008 and 2018, the proportion of STEM jobs requiring a Bachelor's degree will increase from 40 to 42 percent (figure 39). A Master's degree will be required for 18 percent of STEM jobs, and 7 percent will require a doctoral degree by 2018. Slightly more than one-half will require a Bachelor's degree by 2018. Although dominated by workers with a Bachelor's degree or better, the high school and postsecondary middle-skills job market will still comprise 31 percent of STEM jobs by 2018; 10 percent will go to workers with a high school diploma. Few if any jobs will be held by workers with less than high school.

Figure 39. Almost 70 percent of jobs in STEM will require a Bachelor's degree or better by 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Most entry-level jobs in engineering require a Bachelor's degree, although a Master's degree or better is required for some research positions. Engineers at all education levels make a high wage, although average salaries vary based on the field (table 64). Computer and information scientists who work in research and have a Bachelor's degree earn \$75,000; aerospace engineers with similar education earn \$87,000. Continuing education is imperative for engineers to keep pace with current technological advancements. Engineers require periodic certification to maintain licensing requirements usually imposed by the state in which they work and often by employers as evidence of competence.

Table 64. STEM workers can earn more than the MET even with a high school diploma or less; however, increased educational attainment significantly boosts workers' earning potential in these fields.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Engineering managers	—	70,000	91,100	86,300	117,100	134,600
Computer and information scientists, research	—	54,400	59,400	57,400	74,700	88,700
Aerospace engineers	—	68,900	73,600	74,000	86,900	99,600
Computer hardware engineers	—	58,200	67,000	58,500	82,900	96,100
Electrical engineers	—	67,300	68,000	70,000	85,400	102,500
Industrial engineers	—	57,100	61,200	62,600	74,400	81,800
Mechanical engineers	—	60,800	67,000	67,100	77,100	87,500
Engineers, all other	—	62,600	69,300	68,900	82,900	96,400
Architectural and civil drafters	—	45,200	46,900	45,600	46,100	49,100
Electrical and electronic engineering technicians	—	48,800	53,300	54,400	52,900	63,200
Surveying and mapping technicians	—	40,700	46,400	47,900	41,800	—
Chemists	—	—	57,800	52,200	60,700	85,600
Environmental scientists and specialists, including health	—	61,500	53,700	50,900	64,400	83,500
Biological technicians	29,500	38,600	37,000	44,000	49,400	70,400
Chemical technicians	39,400	46,000	49,900	51,300	51,000	65,700
Life, physical, and social science technicians, all other	45,600	39,900	40,400	43,900	42,100	46,700
Technical writers	—	46,300	57,600	53,500	60,000	64,900

^a Some college includes postsecondary vocational certificates.

— Cell data suppressed due to small sample size.

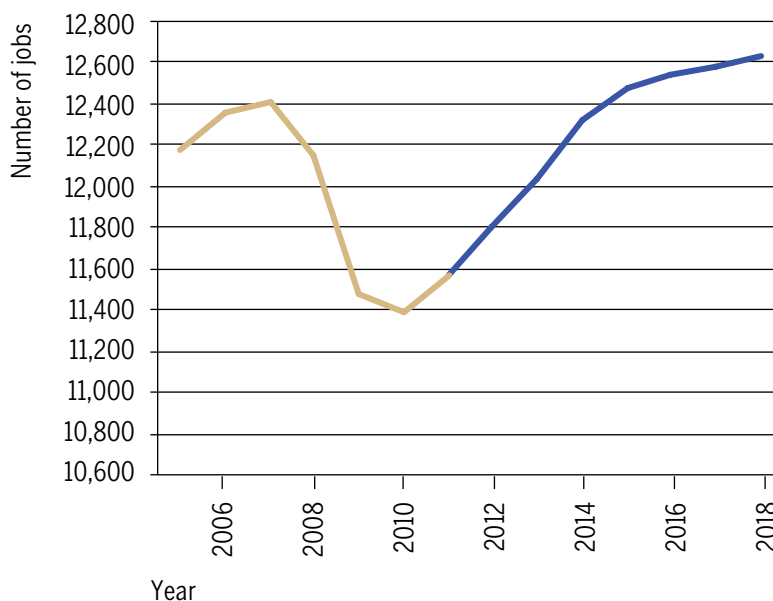
Training for physical scientist technicians and applied scientists is very practical. As a result, training in the latest lab or production equipment is necessary for advancement in the field. Whereas surveying and mapping technicians with some college/no degree earn \$46,000, electrical and electronic engineering technicians with similar education earn \$53,000.

Physical scientists and mathematicians need a doctoral degree to be compete for research, laboratory, and consulting positions due to limited federal, state, and private sector funding. Chemists with a Master's degree or better earn \$86,000, \$25,000 more than their counterparts with a Bachelor's degree. Similarly, environmental scientists and specialists with a Master's degree earn \$19,000 more than their counterparts.

Career Cluster 16: Transportation, Distribution, and Logistics

Jobs in Transportation, Distribution, and Logistics are projected to grow 4 percent between 2008 and 2018, 6 percentage points below the national average (figure 40). By 2018, 39 percent of jobs will require at least some postsecondary education and training (table 65).

Figure 40. Jobs in Transportation, Distribution, and Logistics are projected to grow by little more than 4 percent between 2008 and 2018, 6 percentage points below the national average.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Table 65. Many jobs in Transportation, Distribution, and Logistics require a high school diploma or middle skills.

	PERCENT OF TOTAL JOBS IN CAREER CLUSTER BY EDUCATION (SAMPLE, 2007-2009)						TOTAL (%)
	LESS THAN HIGH SCHOOL (%)	HIGH SCHOOL DIPLOMA (%)	SOME COLLEGE/NO DEGREE ^a (%)	ASSOCIATE'S DEGREE (%)	BACHELOR'S DEGREE (%)	MASTER'S DEGREE OR BETTER (%)	
Billing and posting clerks and machine operators	3	32	36	13	13	2	100
Shipping, receiving, and traffic clerks	15	48	24	6	6	1	100
Logisticians	2	15	27	13	32	10	100
Driver/sales workers and truck drivers	20	50	21	5	4	1	100
Air traffic controllers and airfield operations specialists	1	14	40	16	26	4	100
Aircraft pilots and flight engineers	1	5	12	8	62	13	100
Transportation attendants	4	22	32	11	28	3	100
Aircraft mechanics and service technicians	3	29	36	22	10	1	100
Automotive body and related repairers	24	51	16	6	2	0	100
Automotive service technicians and mechanics	19	45	21	11	3	1	100
Bus and truck mechanics and diesel engine specialists	16	49	23	10	2	0	100
Mobile heavy equipment mechanics, except engines	14	48	23	10	3	0	100
Tire repairers and changers	29	47	17	4	4	1	100
First-line supervisors/managers of helpers, laborers, and material movers, hand	8	36	29	9	15	2	100
Bus drivers, transit and intercity	10	49	28	7	5	1	100
Taxi drivers and chauffeurs	17	39	22	7	12	2	100
Industrial truck and tractor operators	25	52	17	3	2	0	100
Cleaners of vehicles and equipment	36	44	13	4	3	0	100
Laborers and freight, stock, and material movers, hand	22	49	19	5	4	1	100
Packers and packagers, hand	42	40	12	3	3	0	100

^a Some college includes postsecondary vocational certificates.

The deepest decline took place in 2009 in the midst of the recession. Between 2008 and 2009, jobs fell by 6 percent, from 12.2 to 11.5 million, as fewer goods were moving through the global economy. Job growth is expected to recover somewhat in 2012 and taper off starting in 2014.

As globalization and international trade increase, Transportation, Distribution, and Logistics has become more efficient and important. President Obama has proposed a 53 percent increase in his 2012 budget for the Department of Transportation. In his 2011 State of the Union address, President Obama requested an increase of funds for the 2012 federal budget for transportation projects. High-speed rail is also on the Obama administration's agenda and, in the last few years, hundreds of millions of dollars in grants to the states have been disbursed to build high-speed rail lines. It remains to be seen whether infrastructure investments will be long- or short-term. Although these investments will fund repair and maintenance jobs, the larger, longer-term effect on these proposed and realized investments in infrastructure will affect jobs in this career cluster for decades to come.

DISTRIBUTORS AND LOGISTICIANS

Population and economic growth are expected to stimulate job opportunities for workers who coordinate planning, logistics, and operations for transportation companies, warehouses, and distribution centers. More than 20 percent more jobs for cargo and freight agents are projected between 2008 and 2018 to help businesses adjust to industry trends caused by rapid growth in online shopping and the efficiency demands of same-day delivery. Job growth for billing and posting clerks and machine operators, also caused by the increase in economic transactions, is projected at 15 percent; however, growth will be dampened somewhat by advances in efficiency.

Due to demand for cost-saving efficiency services, jobs for logisticians are expected to increase more than 20 percent between 2008 and 2018. Much of the predicted work for logisticians involves helping companies transition to technologically advanced transportation and distribution systems. As a result, some consulting firms that implement these systems are partnering with technology companies to offer more comprehensive services. Methods developed by logisticians and related workers to store, locate, and load materials efficiently within a warehouse or distribution center will limit career growth in warehousing and distribution.

Large distribution companies are predicted to invest in expensive machinery capable of sorting and storing goods with limited worker

involvement. As a result, job opportunities for helpers, laborers, material movers, and corresponding supervisors will decline by a slight 1 percent. Limited growth is also expected for smaller firms that outsource their warehouse functions to contracting companies and manual laborers. Manual laborers and freight, stock, and material movers comprise the vast majority of the 3 million material moving workers employed in the industry. Some decline in jobs for material movers (1% overall) is also expected due to overseas outsourcing in the warehousing industry. As with much of the career cluster, replacement jobs for helpers, laborers, and material movers who work by hand will nevertheless be available. With more advanced technology, new distribution equipment will provide more job opportunities for operators and maintenance workers.

Automatic identification processes will also help to streamline distribution while allowing each item to be accurately tracked from the warehouse to the consumer. The increased use of computerized shipping and receiving records monitored by scanners will decrease job prospects for shipping, receiving, and traffic clerks by 7 percent due to the reduced need for clerks to manage incoming and outgoing shipments.

Other technological advances use inventory management software, just-in-time shipping methods, and GPS to track and monitor the transportation industry. Trends in the trucking industry are expected to lead to some job growth for dispatchers and other coordinators as trucking companies expand beyond transportation services to include full-service logistical and distributive support. Despite the additional openings, jobs for dispatchers and other coordinators, with the exception of police, fire and ambulance, are predicted to decline by 3 percent as trucking companies use efficiency technology to expand beyond transportation services and include full-service logistical and distributive support and other companies increase their use of computer-aided dispatch systems. Similarly, automated systems will make traffic technicians and air traffic controllers much more efficient.

As with the trucking industry, the passenger and cargo air travel industry is predicted to invest in efficiency technology to meet increased travel demands and minimize employee growth. The Federal Aviation Administration (FAA) is particularly concerned with investing in new technology given the growing use of airports and increased national security demands.

GPS also provides more exact data for air traffic controllers, airfield operations specialists, and aircraft cargo handling supervisors. Jobs for

these controllers and supervisors are expected to grow 10 percent despite efficiency initiatives. Domestic cargo transportation is not expected to grow as much as passenger air travel and international cargo transportation. Heightened security measures for airlines and efficiencies in the trucking industry are primary factors reducing domestic air transportation of cargo.

TRANSPORTATION OPERATORS

With almost 3 million employees in the industry, truck drivers transport almost every product consumed in the United States. They provide a necessary link between air, rail, and ship transportation. The increased consumption of goods expected from population growth and economic recovery will stimulate approximately 13 percent job growth for heavy-duty and tractor-trailer truck drivers. However, jobs for light-duty or delivery-service truck drivers are expected to grow by only 4 percent. Despite the growth expected for the trucking industry, employment for truckers is highly dependent on cycles of the U.S. economy.

Ship transport will continue to be necessary for cargo and passengers. Interest in the use of ferries is growing in response to major metropolitan road traffic. Due to high rates of retirement and high levels of training required, jobs for captains, mates, and pilots of water vessels, as well as ship engineers, are expected to increase by 17 percent. Tanker transport will be needed to meet expected increases in offshore oil and gas drilling and production.

Manufacturing output influences growth in the trucking and shipping industries. Job opportunities for industrial truck and tractor operators are expected to grow by only 3 to 6 percent due to the increasing use of motorized distribution technology. Increased outsourcing of warehousing needs to consolidated companies will streamline jobs for first-line supervisors/managers of transportation and material-moving machine and vehicle operators, causing a projected decline in job prospects somewhere between -3 percent and -9 percent.

Job growth for transit and intercity bus drivers is expected to be 8 percent; for school bus drivers, 6 percent. Rising gas prices and environmental concerns will lead to greater demand for intra-city bus travel, among other forms of transportation. Intra-city options will remain limited as long as air travel offers affordable and efficient transportation. Public budget cuts will lead to more efficient bus routes and service reductions, limiting job prospects for school bus drivers.

Career opportunities for conductors and operators of passenger trains are expected to grow due to government-initiated light rail and commuter train service projects. Job growth for subway and streetcar operators is projected to be 19 percent; rail-track laying and maintenance equipment operators, 14 to 19 percent.

Rail-track laying and maintenance equipment operators will be needed due to their specialized construction skills; their job opportunities are expected to grow by 14 to 19 percent between 2008 and 2018. Jobs for railroad break, signal, and switch operators will increase by 9 percent; for railroad conductors and yardmasters, by 7 percent, slightly below average. Fewer entry-level and nonessential rail workers will be needed because automated systems will electronically monitor mechanical difficulties. This change will have a negative effect on job growth for signal and track switch repairers, who will see little to no job growth. Jobs for locomotive engineers and operators are expected to increase by 10 percent as global trade and domestic consumption increases transportation needs in much of the freight transportation industry.

Job growth for taxi drivers and chauffeurs is expected to be 16 percent due to increased tourism and business travel and increased demand from the elderly for transportation. Job growth for taxi drivers and chauffeurs is highly dependent on economic fluctuations because of their dependence on tourism. Similarly, job opportunities for airline pilots, copilots, and flight engineers, as well as commercial pilots and flight attendants, are expected to increase only by about 10 percent; these jobs are also dependent on the business cycle.

TRANSPORTATION MAINTENANCE AND REPAIR WORKERS

The changing automotive industry will require mechanics and technicians to gain highly technical, specialized skills in order to keep up with new trends in production. More specialized workers will be needed to perform maintenance and repair as engines and other automotive systems become computerized. For example, new car models will use more expensive and technologically advanced parts, causing insurance companies to declare lesser collision damage as a total loss of the vehicle. Increased demand for services, however, will not lead to substantial job growth because consolidation in car dealerships and service centers that offer automotive maintenance, repair, and upkeep will reduce opportunities for mechanics and technicians. As a result, auto-body and related repairers, including automotive glass installers and repairers, will experience little or no job growth. Despite increased demand for their services, job prospects for

automotive service technicians and mechanics are projected to increase by only 5 percent. Tire repairers and changers will experience little or no job growth.

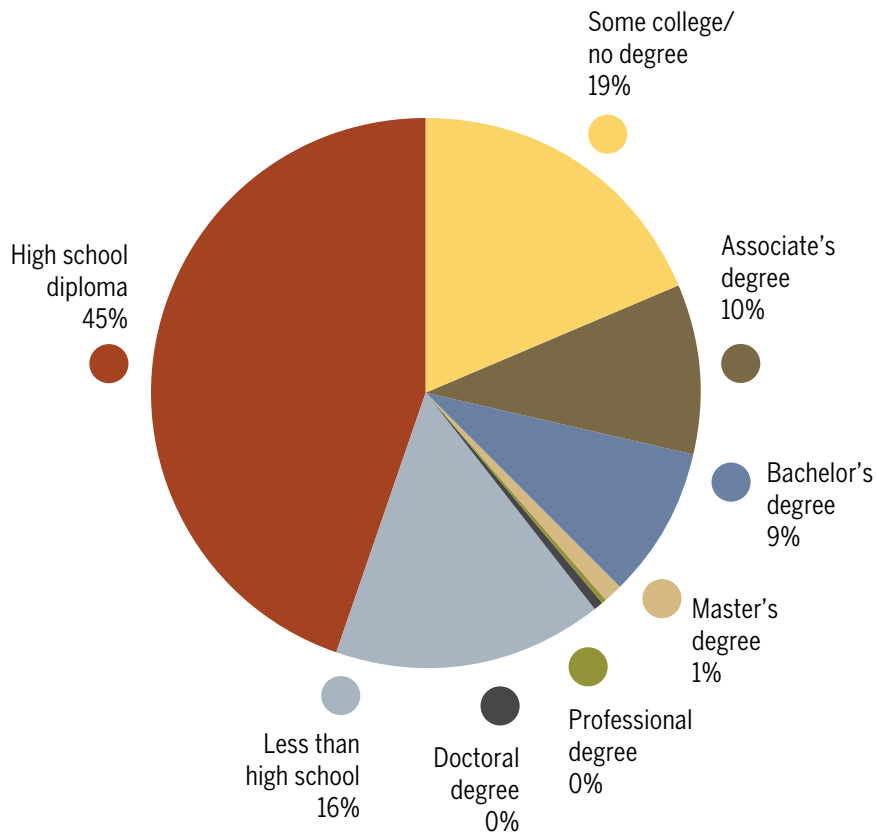
Bus, truck, and heavy-equipment mechanics and technicians will also require increasingly specialized skills to keep pace with technological advances. Job growth for these workers is expected to fall between 3 and 6 percent. Similarly, job growth for mobile heavy-equipment mechanics, not including engine repair, is expected to be 9 percent between 2008 and 2018. Heavy machinery will be increasingly needed for construction work and for energy exploration and mining, although production in those industries is dependent on commodity prices and economic growth. Heavy-equipment mechanics and technicians are also needed for farm use and food production.

Airlines are expected to retire older and less reliable aircraft, which will somewhat reduce the workload for service workers. Job growth for aircraft maintenance and service technicians is projected to be only 6 percent. Jobs for avionics technicians will increase by 11 percent due to their specialized skill set. Positions will become available as retirees and workers leaving the aircraft industry transfer their skills into other maintenance jobs with more desirable schedules, locations, and salaries. Additionally, aircraft mechanic training programs are expected to graduate fewer students than needed for technical and highly skilled job openings. Jobs for aerospace engineering and operations technicians will not increase between 2008 and 2018 because computer simulation technology will make their work much more efficient.

EDUCATION DISTRIBUTION OF TRANSPORTATION, DISTRIBUTION, AND LOGISTICS OCCUPATIONS

Between 2008 and 2018, Transportation, Distribution, and Logistics jobs requiring a Bachelor's degree will increase slightly from 8 to 9 percent. This career cluster contains a high concentration of workers with a high school diploma or less. However, 39 percent of jobs will require at least some postsecondary education by 2018 (figure 4I). Moreover, 29 percent will be in the postsecondary middle-skills job market and require some college/no degree, a postsecondary vocational certificate, an Associate's degree, or a state license or certification by 2018.

Figure 41. About 45 percent of jobs in Transportation, Distribution, and Logistics will require only a high school diploma and on-the-job training in 2018.



SOURCE: The Georgetown University Center on Education and the Workforce forecast of education demand through 2018.

Many workers in Transportation, Distribution, and Logistics must be licensed, especially workers involved in transportation. Whereas aircraft pilots obtain a license from the FAA, truck drivers must carry a commercial driver's license (CDL).

Well over one-half of aircraft pilots and flight engineers hold a Bachelor's degree. Many air traffic controllers and airfield operations specialists have only some college/no degree. Interestingly, air traffic controllers and airfield operations specialists with some college/no degree earn \$95,000, more than the \$87,000 earned by aircraft pilots and flight engineers who hold a Bachelor's degree (table 66).

Table 66. Aircraft pilots and flight engineers, and other jobs within Transportation, Distribution, and Logistics pay wages above the MET at all education levels, but attaining at least some postsecondary education can offer a big earnings boost.

	YEARLY WAGES BY EDUCATION (SAMPLE, 2007-2009)					
	LESS THAN HIGH SCHOOL (\$)	HIGH SCHOOL DIPLOMA (\$)	SOME COLLEGE/NO DEGREE ^a (\$)	ASSOCIATE'S DEGREE (\$)	BACHELOR'S DEGREE (\$)	MASTER'S DEGREE OR BETTER (\$)
Billing and posting clerks and machine operators	24,100	29,400	30,000	29,800	35,000	—
Logisticians	35,900	42,500	45,000	50,500	57,900	76,300
Driver/sales workers and truck drivers	30,000	36,100	36,900	36,900	36,200	32,900
Air traffic controllers and airfield operations specialists	26,400	76,800	94,600	80,700	92,100	95,800
Aircraft pilots and flight engineers	51,100	60,100	66,900	72,900	87,400	107,600
Transportation attendants	12,100	22,400	32,900	32,400	35,000	36,300
Shipping, receiving, and traffic clerks	26,700	29,500	30,100	30,200	30,800	—
Aircraft mechanics and service technicians	42,300	50,800	53,800	55,400	55,000	—
Automotive body and related repairers	30,600	37,000	37,800	41,100	—	—
Automotive service technicians and mechanics	25,700	35,200	38,000	42,300	37,200	—
Bus and truck mechanics and diesel engine specialists	35,400	41,300	43,000	44,700	40,400	—
Mobile heavy equipment mechanics, except engines	36,000	46,200	48,400	48,700	47,300	—
Tire repairers and changers	24,800	30,000	27,200	31,900	26,900	—
First-line supervisors/managers of helpers, laborers, and material movers, hand	39,300	44,400	47,600	45,800	56,500	—
Bus drivers, transit and intercity	24,400	25,800	27,800	29,100	31,600	—
Taxi drivers and chauffeurs	18,700	21,300	23,700	21,000	24,600	—
Industrial truck and tractor operators	27,700	31,500	34,000	33,400	—	—
Cleaners of vehicles and equipment	20,100	22,500	23,900	23,800	27,600	—
Laborers and freight, stock, and material movers, hand	22,300	28,700	31,100	31,200	31,100	—
Packers and packagers, hand	18,000	22,100	22,900	24,200	24,100	—

^a Some college includes postsecondary vocational certificates..

— Cell data suppressed due to small sample size.

One-half of drivers/sales workers and truck drivers obtain a high school diploma. These workers earn \$36,000, slightly above the MET. In contrast, mobile heavy-equipment mechanics (except engine mechanics) with a high school diploma earn \$45,000. One-quarter of auto-body and related repairers have not obtained their high school diploma and, as a result, earn \$6,000 less than their counterparts with a diploma. Tire repairers and changers earn \$30,000 with a high school diploma, \$5,000 more than their coworkers without one (\$25,000).

Bibliography

Allegretto, S. & J. Keefe (2010). The Truth about Public Employees in California: They are Neither Overpaid nor Overcompensated. *Policy Brief*, October 2010, Center on Wage and Employment Dynamics. Berkeley: Institute for Research on Labor and Employment, University of California.

Balfanz, Robert, "Can the American High School Become an Avenue of Advancement for All?" in *American's High Schools, The Future of Children*. Princeton and Brookings Institution, Volume 19, Number 1, Spring 2009.

Barton, Paul E. and Richard J. Coley. The Mission of High School: A New Consensus of the Purposes of Public Education? *Policy Information Perspective*. Educational Testing Service (ETS), 2011.

Baum, S. & J. Ma (2008). Trends in college pricing. *Trends in Higher Education Series*. Washington DC: The College Board Advocacy & Policy Center.

Carl D. Perkins Career and Technical Education Act of 2006, Pub. L. No. 109-270 (2006).

Carnevale, Anthony P. & S.J. Rose (2001). Low earners: Who are they? Do they have a way out? In R. Kazis & M. S. Miller (Eds.), *Low-Wage Workers in the New Economy* (pp. 45-67). Washington, DC: The Urban Institute Press.

Carnevale, Anthony P., S.J. Rose & B. Cheah (2011). *The College Payoff: Education, occupations, and lifetime earnings*. Washington, DC: The Georgetown University Center on Education and the Workforce.

Carnevale, Anthony P., N. Smith & J. Strohl (2010). *Help Wanted: Projections of jobs and education requirements through 2018*. Washington, DC: Center on Education and the Workforce, Georgetown University.

Carnevale, Anthony P., J. Strohl & M. Melton (2011). *What's It Worth: The economic value of college majors*. Washington, DC: The Georgetown University Center on Education and the Workforce.

Casner-Lotto, Jill, Linda Barrington, and Mary Wright, Are they Really Ready to Work? Employers' Perspectives on the Basic Knowledge and Applied Skills of New Entrants to the 21st Century U.S. Workforce. *The Conference Board*, October 2006.

Cheeseman Day, J. & C.E. Newburger. (2010). The Big Payoff: Educational attainment and synthetic estimates of work-life earnings. *Current Population Reports*, 23–210. Washington, DC: U.S. Census Bureau.

Cooney, M. (2011, February 25). IT graduates in demand but have skills gap. *Network World*. Retrieved from <http://www.networkworld.com/news/2011/022511-it-graduates.html>.

Goldin, C. & L.F. Katz (2008). *The Race Between Education and Technology*. Cambridge, MA: Harvard University Press.

Grubb, N.W. & M. Lazerson (2005). Vocationalism in Higher Education: The triumph of the education gospel. *The Journal of Higher Education*, 76(1), 1-25.

Heckman, James J., and Paul A. LaFontaine. "The American High School Graduation Rate: Trends and Levels." NBER Working Paper no 13670, National Bureau of Economic Research Inc., 2007.

McKinsey Global Institute. (2009). *Changing the Fortunes of America's Workforce: A human capital challenge*. N.p.: McKinsey and Company.

National Center for Education Statistics. (2010). *Digest of Education Statistics 2009*. Washington, DC: U.S. Department of Education.

Silvestri, G.T. (1997). Occupational Employment Projections to 2006. *Monthly Labor Review*, 120(11), 58-83.

Symonds, William C., Robert B. Schwartz, and Ronald Ferguson. "Pathways to Prosperity: Making the Challenge of Preparing Young Americans for the 21st Century." Harvard Graduate School of Education, February 2011.

List of Occupations and Career Clusters

SOC	Occupation name	Cluster number	Cluster name
11-9011	Farm, ranch, and other agricultural managers	1	Agriculture food and natural resources
11-9012	Farmers and ranchers	1	Agriculture food and natural resources
11-9121	Natural sciences managers	1	Agriculture food and natural resources
13-1021	Purchasing agents and buyers, farm products	1	Agriculture food and natural resources
17-1021	Cartographers and photogrammetrists	1	Agriculture food and natural resources
17-2081	Environmental engineers	1	Agriculture food and natural resources
17-3025	Environmental engineering technicians	1	Agriculture food and natural resources
19-1011	Animal scientists	1	Agriculture food and natural resources
19-1012	Food scientists and technologists	1	Agriculture food and natural resources
19-1013	Soil and plant Scientists	1	Agriculture food and natural resources
19-1023	Zoologists and wildlife biologists	1	Agriculture food and natural resources
19-1032	Foresters	1	Agriculture food and natural resources
19-4041	Geological and petroleum technicians	1	Agriculture food and natural resources
19-4091	Environmental science and protection technicians, including health	1	Agriculture food and natural resources
19-4093	Forest and conservation technicians	1	Agriculture food and natural resources
25-9021	Farm and home management advisors	1	Agriculture food and natural resources
29-1131	Veterinarians	1	Agriculture food and natural resources
29-2056	Veterinary technologists and technicians	1	Agriculture food and natural resources
29-9011	Occupational health and safety specialists	1	Agriculture food and natural resources
29-9012	Occupational health and safety technicians	1	Agriculture food and natural resources
31-9096	Veterinary assistants and laboratory animal caretakers	1	Agriculture food and natural resources
33-3031	Fish and game wardens	1	Agriculture food and natural resources
37-1012	First-line supervisors/managers of landscaping, lawn service, and groundskeeping workers	1	Agriculture food and natural resources
37-2021	Pest control workers	1	Agriculture food and natural resources
37-3012	Pesticide handlers, sprayers, and applicators, vegetation	1	Agriculture food and natural resources
37-3013	Tree trimmers and pruners	1	Agriculture food and natural resources
37-3019	Grounds maintenance workers, all other	1	Agriculture food and natural resources
39-2021	Nonfarm animal caretakers	1	Agriculture food and natural resources
41-1011	First-line supervisors/managers of retail sales workers	1	Agriculture food and natural resources
41-2022	Parts salespersons	1	Agriculture food and natural resources
45-1099	Supervisors, farming, fishing, and forestry workers	1	Agriculture food and natural resources
45-2011	Agricultural inspectors	1	Agriculture food and natural resources
45-2021	Animal breeders	1	Agriculture food and natural resources
45-2041	Graders and sorters, agricultural products	1	Agriculture food and natural resources
45-2091	Agricultural equipment operators	1	Agriculture food and natural resources
45-2092	Farmworkers and laborers, crop, nursery, and greenhouse	1	Agriculture food and natural resources
45-2093	Farmworkers, farm and ranch animals	1	Agriculture food and natural resources
45-2099	Agricultural workers, all other	1	Agriculture food and natural resources
45-3011	Fishers and related fishing workers	1	Agriculture food and natural resources
45-4011	Forest and conservation workers	1	Agriculture food and natural resources
45-4021	Fallers	1	Agriculture food and natural resources
45-4022	Logging equipment operators	1	Agriculture food and natural resources
45-4023	Log graders and scalers	1	Agriculture food and natural resources
45-4029	Logging workers, all other	1	Agriculture food and natural resources
47-5011	Derrick operators, oil and gas	1	Agriculture food and natural resources
47-5012	Rotary drill operators, oil and gas	1	Agriculture food and natural resources
47-5013	Service unit operators, oil, gas, and mining	1	Agriculture food and natural resources
47-5031	Explosives workers, ordnance handling experts, and blasters	1	Agriculture food and natural resources
47-5041	Continuous mining machine operators	1	Agriculture food and natural resources

APPENDIX A: List of Occupations and Career Clusters (continued)

47-5042	Mine cutting and channeling machine operators	1	Agriculture food and natural resources
47-5049	Mining machine operators, all other	1	Agriculture food and natural resources
47-5051	Rock splitters, quarry	1	Agriculture food and natural resources
47-5061	Roof bolters, mining	1	Agriculture food and natural resources
47-5071	Roustabouts, oil and gas	1	Agriculture food and natural resources
47-5081	Helpers, extraction workers	1	Agriculture food and natural resources
47-5099	Extraction workers, all other	1	Agriculture food and natural resources
49-3041	Farm equipment mechanics	1	Agriculture food and natural resources
49-9092	Commercial divers	1	Agriculture food and natural resources
51-3021	Butchers and meat cutters	1	Agriculture food and natural resources
51-3022	Meat, poultry, and fish cutters and trimmers	1	Agriculture food and natural resources
51-3023	Slaughterers and meat packers	1	Agriculture food and natural resources
51-3091	Food and tobacco roasting, baking, and drying machine operators and tenders	1	Agriculture food and natural resources
51-3092	Food batchmakers	1	Agriculture food and natural resources
51-3093	Food cooking machine operators and tenders	1	Agriculture food and natural resources
51-7032	Patternmakers, wood	1	Agriculture food and natural resources
51-7041	Sawing machine setters, operators, and tenders, wood	1	Agriculture food and natural resources
51-8031	Water and liquid waste treatment plant and system operators	1	Agriculture food and natural resources
51-8092	Gas plant operators	1	Agriculture food and natural resources
51-8093	Petroleum pump system operators, refinery operators, and gaugers	1	Agriculture food and natural resources
53-7033	Loading machine operators, underground mining	1	Agriculture food and natural resources
53-7071	Gas compressor and gas pumping station operators	1	Agriculture food and natural resources
53-7072	Pump operators, except wellhead pumpers	1	Agriculture food and natural resources
53-7073	Wellhead pumpers	1	Agriculture food and natural resources
53-7081	Refuse and recyclable material collectors	1	Agriculture food and natural resources
53-7111	Shuttle car operators	1	Agriculture food and natural resources
11-9021	Construction managers	2	Architecture and Construction
13-1051	Cost estimators	2	Architecture and Construction
17-1011	Architects, except landscape and naval	2	Architecture and Construction
17-1012	Landscape architects	2	Architecture and Construction
17-1022	Surveyors	2	Architecture and Construction
17-2051	Civil engineers	2	Architecture and Construction
17-3013	Mechanical drafters	2	Architecture and Construction
17-3019	Drafters, all other	2	Architecture and Construction
17-3022	Civil engineering technicians	2	Architecture and Construction
27-1025	Interior designers	2	Architecture and Construction
37-3011	Landscaping and groundskeeping workers	2	Architecture and Construction
47-1011	First-line supervisors/managers of construction trades and extraction workers	2	Architecture and Construction
47-2021	Brickmasons and blockmasons	2	Architecture and Construction
47-2022	Stonemasons	2	Architecture and Construction
47-2031	Carpenters	2	Architecture and Construction
47-2041	Carpet installers	2	Architecture and Construction
47-2042	Floor layers, except carpet, wood, and hard tiles	2	Architecture and Construction
47-2043	Floor sanders and finishers	2	Architecture and Construction
47-2044	Tile and marble setters	2	Architecture and Construction
47-2051	Cement masons and concrete finishers	2	Architecture and Construction
47-2053	Terrazzo workers and finishers	2	Architecture and Construction
47-2061	Construction laborers	2	Architecture and Construction
47-2071	Paving, surfacing, and tamping equipment operators	2	Architecture and Construction
47-2072	Pile-driver operators	2	Architecture and Construction
47-2073	Operating engineers and other construction equipment operators	2	Architecture and Construction
47-2081	Drywall and ceiling tile installers	2	Architecture and Construction
47-2082	Tapers	2	Architecture and Construction
47-2111	Electricians	2	Architecture and Construction
47-2121	Glaziers	2	Architecture and Construction
47-2131	Insulation workers, floor, ceiling, and wall	2	Architecture and Construction
47-2132	Insulation workers, mechanical	2	Architecture and Construction
47-2141	Painters, construction and maintenance	2	Architecture and Construction
47-2142	Paperhangers	2	Architecture and Construction
47-2151	Pipelayers	2	Architecture and Construction

APPENDIX A: List of Occupations and Career Clusters (continued)

47-2152	Plumbers, pipefitters, and steamfitters	2	Architecture and Construction
47-2161	Plasterers and stucco masons	2	Architecture and Construction
47-2171	Reinforcing iron and rebar workers	2	Architecture and Construction
47-2181	Roofers	2	Architecture and Construction
47-2211	Sheet metal workers	2	Architecture and Construction
47-2221	Structural iron and steel workers	2	Architecture and Construction
47-3011	Helpers, brickmasons, blockmasons, stonemasons, and tile and marble setters	2	Architecture and Construction
47-3012	Helpers, carpenters	2	Architecture and Construction
47-3013	Helpers, electricians	2	Architecture and Construction
47-3014	Helpers, painters, paperhangers, plasterers, and stucco masons	2	Architecture and Construction
47-3015	Helpers, pipelayers, plumbers, pipefitters, and steamfitters	2	Architecture and Construction
47-3016	Helpers, roofers	2	Architecture and Construction
47-3019	Helpers, construction trades, all other	2	Architecture and Construction
47-4011	Construction and building inspectors	2	Architecture and Construction
47-4021	Elevator installers and repairers	2	Architecture and Construction
47-4031	Fence erectors	2	Architecture and Construction
47-4041	Hazardous materials removal workers	2	Architecture and Construction
47-4051	Highway maintenance workers	2	Architecture and Construction
47-4071	Septic tank servicers and sewer pipe cleaners	2	Architecture and Construction
47-4091	Segmental pavers	2	Architecture and Construction
47-4099	Construction and related workers, all other	2	Architecture and Construction
47-5021	Earth drillers, except oil and gas	2	Architecture and Construction
49-2095	Electrical and electronics repairers, powerhouse, substation, and relay	2	Architecture and Construction
49-9011	Mechanical door repairers	2	Architecture and Construction
49-9012	Control and valve installers and repairers, except mechanical door	2	Architecture and Construction
49-9021	Heating, air conditioning, and refrigeration mechanics and installers	2	Architecture and Construction
49-9031	Home appliance repairers	2	Architecture and Construction
49-9045	Refractory materials repairers, except brickmasons	2	Architecture and Construction
49-9051	Electrical power-line installers and repairers	2	Architecture and Construction
49-9095	Manufactured building and mobile home installers	2	Architecture and Construction
49-9096	Riggers	2	Architecture and Construction
49-9098	Helpers--Installation, maintenance, and repair workers	2	Architecture and Construction
49-9099	Installation, maintenance, and repair workers, all other	2	Architecture and Construction
51-2041	Structural metal fabricators and fitters	2	Architecture and Construction
51-8021	Stationary engineers and boiler operators	2	Architecture and Construction
53-7011	Conveyor operators and tenders	2	Architecture and Construction
53-7021	Crane and tower operators	2	Architecture and Construction
53-7031	Dredge operators	2	Architecture and Construction
53-7032	Excavating and loading machine and dragline operators	2	Architecture and Construction
53-7041	Hoist and winch operators	2	Architecture and Construction
27-1012	Craft artists	3	Arts, A/V Technology and Communications
27-1013	Fine artists, including painters, sculptors, and illustrators	3	Arts, A/V Technology and Communications
27-1014	Multi-media artists and animators	3	Arts, A/V Technology and Communications
27-1019	Artists and related workers, all other	3	Arts, A/V Technology and Communications
27-1021	Commercial and industrial designers	3	Arts, A/V Technology and Communications
27-1024	Graphic designers	3	Arts, A/V Technology and Communications
27-2011	Actors	3	Arts, A/V Technology and Communications
27-2012	Producers and directors	3	Arts, A/V Technology and Communications
27-2031	Dancers	3	Arts, A/V Technology and Communications
27-2032	Choreographers	3	Arts, A/V Technology and Communications
27-2041	Music directors and composers	3	Arts, A/V Technology and Communications
27-2042	Musicians and singers	3	Arts, A/V Technology and Communications
27-2099	Entertainers and performers, sports and related workers, all other	3	Arts, A/V Technology and Communications
27-3011	Radio and television announcers	3	Arts, A/V Technology and Communications
27-3012	Public address system and other announcers	3	Arts, A/V Technology and Communications
27-3021	Broadcast news analysts	3	Arts, A/V Technology and Communications
27-3022	Reporters and correspondents	3	Arts, A/V Technology and Communications
27-3041	Editors	3	Arts, A/V Technology and Communications
27-3043	Writers and authors	3	Arts, A/V Technology and Communications
27-3099	Media and communication workers, all other	3	Arts, A/V Technology and Communications

APPENDIX A: List of Occupations and Career Clusters (continued)

27-4011	Audio and video equipment technicians	3	Arts, A/V Technology and Communications
27-4012	Broadcast technicians	3	Arts, A/V Technology and Communications
27-4013	Radio operators	3	Arts, A/V Technology and Communications
27-4014	Sound engineering technicians	3	Arts, A/V Technology and Communications
27-4021	Photographers	3	Arts, A/V Technology and Communications
27-4031	Camera operators, television, video, and motion picture	3	Arts, A/V Technology and Communications
27-4032	Film and video editors	3	Arts, A/V Technology and Communications
27-4099	Media and communication equipment workers, all other	3	Arts, A/V Technology and Communications
39-5091	Makeup artists, theatrical and performance	3	Arts, A/V Technology and Communications
43-9031	Desktop publishers	3	Arts, A/V Technology and Communications
49-9052	Telecommunications line installers and repairers	3	Arts, A/V Technology and Communications
49-9061	Camera and photographic equipment repairers	3	Arts, A/V Technology and Communications
51-5011	Bindery workers	3	Arts, A/V Technology and Communications
51-5012	Bookbinders	3	Arts, A/V Technology and Communications
51-5021	Job printers	3	Arts, A/V Technology and Communications
51-5022	Prepress technicians and workers	3	Arts, A/V Technology and Communications
51-5023	Printing machine operators	3	Arts, A/V Technology and Communications
11-1011	Chief executives	4	Business, Management and Administration
11-1021	General and operations managers	4	Business, Management and Administration
11-2011	Advertising and promotions managers	4	Business, Management and Administration
11-2021	Marketing managers	4	Business, Management and Administration
11-2022	Sales managers	4	Business, Management and Administration
11-2031	Public relations managers	4	Business, Management and Administration
11-3011	Administrative services managers	4	Business, Management and Administration
11-3031	Financial managers	4	Business, Management and Administration
11-3041	Compensation and benefits managers	4	Business, Management and Administration
11-3042	Training and development managers	4	Business, Management and Administration
11-3049	Human resources managers, all other	4	Business, Management and Administration
11-3061	Purchasing managers	4	Business, Management and Administration
11-9111	Medical and health services managers	4	Business, Management and Administration
11-9199	Managers, all other	4	Business, Management and Administration
13-1011	Agents and business managers of artists, performers, and athletes	4	Business, Management and Administration
13-1071	Employment, recruitment, and placement specialists	4	Business, Management and Administration
13-1072	Compensation, benefits, and job analysis specialists	4	Business, Management and Administration
13-1073	Training and development specialists	4	Business, Management and Administration
13-1079	Human resources, training, and labor relations specialists, all other	4	Business, Management and Administration
13-1111	Management analysts	4	Business, Management and Administration
13-1199	Business operation specialists, all other	4	Business, Management and Administration
13-2011	Accountants and auditors	4	Business, Management and Administration
13-2031	Budget analysts	4	Business, Management and Administration
15-2031	Operations research analysts	4	Business, Management and Administration
23-2091	Court reporters	4	Business, Management and Administration
27-1011	Art directors	4	Business, Management and Administration
27-3031	Public relations specialists	4	Business, Management and Administration
41-3011	Advertising sales agents	4	Business, Management and Administration
43-1011	First-line supervisors/managers of office and administrative support workers	4	Business, Management and Administration
43-2021	Telephone operators	4	Business, Management and Administration
43-2099	Communications equipment operators, all other	4	Business, Management and Administration
43-3031	Bookkeeping, accounting, and auditing clerks	4	Business, Management and Administration
43-3051	Payroll and timekeeping clerks	4	Business, Management and Administration
43-4021	Correspondence clerks	4	Business, Management and Administration
43-4071	File clerks	4	Business, Management and Administration
43-4121	Library assistants, clerical	4	Business, Management and Administration
43-4141	New accounts clerks	4	Business, Management and Administration
43-4161	Human resources assistants, except payroll and timekeeping	4	Business, Management and Administration
43-4171	Receptionists and information clerks	4	Business, Management and Administration
43-4199	Information and record clerks, all other	4	Business, Management and Administration
43-5021	Couriers and messengers	4	Business, Management and Administration
43-5081	Stock clerks and order fillers	4	Business, Management and Administration
43-6011	Executive secretaries and administrative assistants	4	Business, Management and Administration

APPENDIX A: List of Occupations and Career Clusters (continued)

43-6012	Legal secretaries	4	Business, Management and Administration
43-6013	Medical secretaries	4	Business, Management and Administration
43-6014	Secretaries, except legal, medical, and executive	4	Business, Management and Administration
43-9011	Computer operators	4	Business, Management and Administration
43-9021	Data entry keyers	4	Business, Management and Administration
43-9022	Word processors and typists	4	Business, Management and Administration
43-9051	Mail clerks and mail machine operators, except postal service	4	Business, Management and Administration
43-9199	Office and administrative support workers, all other	4	Business, Management and Administration
53-3031	Driver/sales workers	4	Business, Management and Administration
11-9031	Education administrators, preschool and child care center/program	5	Education and Training
11-9032	Education administrators, elementary and secondary school	5	Education and Training
11-9033	Education administrators, postsecondary	5	Education and Training
11-9039	Education administrators, all other	5	Education and Training
19-3031	Clinical, counseling, and school psychologists	5	Education and Training
21-1012	Educational, vocational, and school counselors	5	Education and Training
25-1099	Postsecondary teachers	5	Education and Training
25-2011	Preschool teachers, except special education	5	Education and Training
25-2012	Kindergarten teachers, except special education	5	Education and Training
25-2021	Elementary school teachers, except special education	5	Education and Training
25-2022	Middle school teachers, except special and vocational education	5	Education and Training
25-2023	Vocational education teachers, middle school	5	Education and Training
25-2031	Secondary school teachers, except special and vocational education	5	Education and Training
25-2032	Vocational education teachers, secondary school	5	Education and Training
25-2041	Special education teachers, preschool, kindergarten, and elementary school	5	Education and Training
25-2042	Special education teachers, middle school	5	Education and Training
25-2043	Special education teachers, secondary school	5	Education and Training
25-3011	Adult literacy, remedial education, and GED teachers and instructors	5	Education and Training
25-3099	Teachers and instructors, all other	5	Education and Training
25-4011	Archivists	5	Education and Training
25-4012	Curators	5	Education and Training
25-4021	Librarians	5	Education and Training
25-4031	Library technicians	5	Education and Training
25-9011	Audio-visual collections specialists	5	Education and Training
25-9031	Instructional coordinators	5	Education and Training
25-9041	Teacher assistants	5	Education and Training
25-9099	Education, training, and library workers, all other	5	Education and Training
27-2022	Coaches and scouts	5	Education and Training
13-1031	Claims adjusters, examiners, and investigators	6	Finance
13-1032	Insurance appraisers, auto damage	6	Finance
13-2041	Credit analysts	6	Finance
13-2051	Financial analysts	6	Finance
13-2052	Personal financial advisors	6	Finance
13-2053	Insurance underwriters	6	Finance
13-2072	Loan officers	6	Finance
13-2082	Tax preparers	6	Finance
13-2099	Financial specialists, all other	6	Finance
15-2011	Actuaries	6	Finance
23-2093	Title examiners, abstractors, and searchers	6	Finance
41-3021	Insurance sales agents	6	Finance
41-3031	Securities, commodities, and financial services sales agents	6	Finance
43-3011	Bill and account collectors	6	Finance
43-3071	Tellers	6	Finance
43-4011	Brokerage clerks	6	Finance
43-4041	Credit authorizers, checkers, and clerks	6	Finance
43-4131	Loan interviewers and clerks	6	Finance
43-9041	Insurance claims and policy processing clerks	6	Finance
43-9071	Office machine operators, except computer	6	Finance
43-9081	Proofreaders and copy markers	6	Finance
11-1031	Legislators	7	Government and Public Administration
11-9131	Postmasters and mail superintendents	7	Government and Public Administration

APPENDIX A: List of Occupations and Career Clusters (continued)

13-1041	Compliance officers, except agriculture, construction, health and safety, and transportation	7	Government and Public Administration
13-2021	Appraisers and assessors of real estate	7	Government and Public Administration
13-2061	Financial examiners	7	Government and Public Administration
13-2081	Tax examiners, collectors, and revenue agents	7	Government and Public Administration
19-3011	Economists	7	Government and Public Administration
19-3051	Urban and regional planners	7	Government and Public Administration
33-3021	Detectives and criminal investigators	7	Government and Public Administration
43-4031	Court, municipal, and license clerks	7	Government and Public Administration
43-4061	Eligibility interviewers, government programs	7	Government and Public Administration
43-4111	Interviewers, except eligibility and loan	7	Government and Public Administration
43-5041	Meter readers, utilities	7	Government and Public Administration
43-5051	Postal service clerks	7	Government and Public Administration
43-5052	Postal service mail carriers	7	Government and Public Administration
43-5053	Postal service mail sorters, processors, and processing machine operators	7	Government and Public Administration
43-9111	Statistical assistants	7	Government and Public Administration
53-6051	Transportation inspectors	7	Government and Public Administration
17-2031	Biomedical engineers	8	Health Science
19-1041	Epidemiologists	8	Health Science
19-1042	Medical scientists, except epidemiologists	8	Health Science
21-1023	Mental health and substance abuse social workers	8	Health Science
21-1091	Health educators	8	Health Science
29-1011	Chiropractors	8	Health Science
29-1021	Dentists, general	8	Health Science
29-1022	Oral and maxillofacial surgeons	8	Health Science
29-1023	Orthodontists	8	Health Science
29-1024	Prosthodontists	8	Health Science
29-1029	Dentists, all other specialists	8	Health Science
29-1031	Dietitians and nutritionists	8	Health Science
29-1041	Optometrists	8	Health Science
29-1051	Pharmacists	8	Health Science
29-1069	Physicians and surgeons	8	Health Science
29-1071	Physician assistants	8	Health Science
29-1081	Podiatrists	8	Health Science
29-1111	Registered nurses	8	Health Science
29-1121	Audiologists	8	Health Science
29-1122	Occupational therapists	8	Health Science
29-1123	Physical therapists	8	Health Science
29-1124	Radiation therapists	8	Health Science
29-1125	Recreational therapists	8	Health Science
29-1126	Respiratory therapists	8	Health Science
29-1127	Speech-language pathologists	8	Health Science
29-1129	Therapists, all other	8	Health Science
29-1199	Health diagnosing and treating practitioners, all other	8	Health Science
29-2011	Medical and clinical laboratory technologists	8	Health Science
29-2012	Medical and clinical laboratory technicians	8	Health Science
29-2021	Dental hygienists	8	Health Science
29-2031	Cardiovascular technologists and technicians	8	Health Science
29-2032	Diagnostic medical sonographers	8	Health Science
29-2033	Nuclear medicine technologists	8	Health Science
29-2034	Radiologic technologists and technicians	8	Health Science
29-2051	Dietetic technicians	8	Health Science
29-2052	Pharmacy technicians	8	Health Science
29-2053	Psychiatric technicians	8	Health Science
29-2054	Respiratory therapy technicians	8	Health Science
29-2055	Surgical technologists	8	Health Science
29-2061	Licensed practical and licensed vocational nurses	8	Health Science
29-2071	Medical records and health information technicians	8	Health Science
29-2081	Opticians, dispensing	8	Health Science
29-2091	Orthotists and prosthetists	8	Health Science
29-2099	Healthcare technologists and technicians, all other	8	Health Science

APPENDIX A: List of Occupations and Career Clusters (continued)

29-9091	Athletic trainers	8	Health Science
29-9099	Healthcare practitioners and technical workers, all other	8	Health Science
31-1011	Home health aides	8	Health Science
31-1012	Nursing aides, orderlies, and attendants	8	Health Science
31-1013	Psychiatric aides	8	Health Science
31-2011	Occupational therapist assistants	8	Health Science
31-2012	Occupational therapist aides	8	Health Science
31-2021	Physical therapist assistants	8	Health Science
31-2022	Physical therapist aides	8	Health Science
31-9091	Dental assistants	8	Health Science
31-9092	Medical assistants	8	Health Science
31-9093	Medical equipment preparers	8	Health Science
31-9094	Medical transcriptionists	8	Health Science
31-9095	Pharmacy aides	8	Health Science
31-9099	Healthcare support workers, all other	8	Health Science
51-9081	Dental laboratory technicians	8	Health Science
51-9083	Ophthalmic laboratory technicians	8	Health Science
11-9051	Food service managers	9	Hospitality and Tourism
11-9071	Gaming managers	9	Hospitality and Tourism
11-9081	Lodging managers	9	Hospitality and Tourism
13-1121	Meeting and convention planners	9	Hospitality and Tourism
25-3021	Self-enrichment education teachers	9	Hospitality and Tourism
25-4013	Museum Technicians and Conservators	9	Hospitality and Tourism
27-1027	Set and exhibit designers	9	Hospitality and Tourism
27-1029	Designers, all other	9	Hospitality and Tourism
27-2021	Athletes and sports competitors	9	Hospitality and Tourism
27-2023	Umpires, referees, and other sports officials	9	Hospitality and Tourism
27-3091	Interpreters and translators	9	Hospitality and Tourism
35-1011	Chefs and head cooks	9	Hospitality and Tourism
35-1012	First-line supervisors/managers of food preparation and serving workers	9	Hospitality and Tourism
35-2011	Cooks, fast food	9	Hospitality and Tourism
35-2012	Cooks, institution and cafeteria	9	Hospitality and Tourism
35-2013	Cooks, private household	9	Hospitality and Tourism
35-2014	Cooks, restaurant	9	Hospitality and Tourism
35-2015	Cooks, short order	9	Hospitality and Tourism
35-2019	Cooks, all other	9	Hospitality and Tourism
35-2021	Food preparation workers	9	Hospitality and Tourism
35-3011	Bartenders	9	Hospitality and Tourism
35-3021	Combined food preparation and serving workers, including fast food	9	Hospitality and Tourism
35-3022	Counter attendants, cafeteria, food concession, and coffee shop	9	Hospitality and Tourism
35-3031	Waiters and waitresses	9	Hospitality and Tourism
35-3041	Food servers, nonrestaurant	9	Hospitality and Tourism
35-9011	Dining room and cafeteria attendants and bartender helpers	9	Hospitality and Tourism
35-9021	Dishwashers	9	Hospitality and Tourism
35-9031	Hosts and hostesses, restaurant, lounge, and coffee shop	9	Hospitality and Tourism
35-9099	Food preparation and serving related workers, all other	9	Hospitality and Tourism
37-1011	First-line supervisors/managers of housekeeping and janitorial workers	9	Hospitality and Tourism
37-2011	Janitors and cleaners, except maids and housekeeping cleaners	9	Hospitality and Tourism
37-2012	Maids and housekeeping cleaners	9	Hospitality and Tourism
37-2019	Building cleaning workers, all other	9	Hospitality and Tourism
39-1011	Gaming supervisors	9	Hospitality and Tourism
39-1012	Slot key persons	9	Hospitality and Tourism
39-2011	Animal trainers	9	Hospitality and Tourism
39-3011	Gaming dealers	9	Hospitality and Tourism
39-3012	Gaming and sports book writers and runners	9	Hospitality and Tourism
39-3019	Gaming service workers, all other	9	Hospitality and Tourism
39-3021	Motion picture projectionists	9	Hospitality and Tourism
39-3031	Ushers, lobby attendants, and ticket takers	9	Hospitality and Tourism
39-3091	Amusement and recreation attendants	9	Hospitality and Tourism
39-3092	Costume attendants	9	Hospitality and Tourism

APPENDIX A: List of Occupations and Career Clusters (continued)

39-3093	Locker room, coatroom, and dressing room attendants	9	Hospitality and Tourism
39-3099	Entertainment attendants and related workers, all other	9	Hospitality and Tourism
39-6011	Baggage porters and bellhops	9	Hospitality and Tourism
39-6012	Concierges	9	Hospitality and Tourism
39-6021	Tour guides and escorts	9	Hospitality and Tourism
39-6022	Travel guides	9	Hospitality and Tourism
39-6032	Transportation attendants, except flight attendants and baggage porters	9	Hospitality and Tourism
39-9032	Recreation workers	9	Hospitality and Tourism
41-2012	Gaming change persons and booth cashiers	9	Hospitality and Tourism
41-3041	Travel agents	9	Hospitality and Tourism
43-2011	Switchboard operators, including answering service	9	Hospitality and Tourism
43-3041	Gaming cage workers	9	Hospitality and Tourism
43-4081	Hotel, motel, and resort desk clerks	9	Hospitality and Tourism
43-4181	Reservation and transportation ticket agents and travel clerks	9	Hospitality and Tourism
51-3011	Bakers	9	Hospitality and Tourism
51-9012	Separating, filtering, clarifying, precipitating, and still machine setters, operators, and tenders	9	Hospitality and Tourism
11-9061	Funeral directors	10	Human Services
11-9141	Property, real estate, and community association managers	10	Human Services
11-9151	Social and community service managers	10	Human Services
13-2071	Loan counselors	10	Human Services
19-3032	Industrial-organizational psychologists	10	Human Services
19-3039	Psychologists, all other	10	Human Services
19-3041	Sociologists	10	Human Services
19-3099	Social scientists and related workers, all other	10	Human Services
21-1011	Substance abuse and behavioral disorder counselors	10	Human Services
21-1013	Marriage and family therapists	10	Human Services
21-1014	Mental health counselors	10	Human Services
21-1015	Rehabilitation counselors	10	Human Services
21-1019	Counselors, all other	10	Human Services
21-1021	Child, family, and school social workers	10	Human Services
21-1022	Medical and public health social workers	10	Human Services
21-1093	Social and human service assistants	10	Human Services
21-1099	Community and social service specialists, all other	10	Human Services
21-2011	Clergy	10	Human Services
21-2021	Directors, religious activities and education	10	Human Services
21-2099	Religious workers, all other	10	Human Services
31-9011	Massage therapists	10	Human Services
39-1021	First-line supervisors/managers of personal service workers	10	Human Services
39-4011	Embalmers	10	Human Services
39-4021	Funeral attendants	10	Human Services
39-5011	Barbers	10	Human Services
39-5012	Hairdressers, hairstylists, and cosmetologists	10	Human Services
39-5092	Manicurists and pedicurists	10	Human Services
39-5093	Shampooers	10	Human Services
39-5094	Skin care specialists	10	Human Services
39-9011	Child care workers	10	Human Services
39-9021	Personal and home care aides	10	Human Services
39-9031	Fitness trainers and aerobics instructors	10	Human Services
39-9041	Residential advisors	10	Human Services
39-9099	Personal care and service workers, all other	10	Human Services
51-6011	Laundry and dry-cleaning workers	10	Human Services
51-6021	Pressers, textile, garment, and related materials	10	Human Services
51-6052	Tailors, dressmakers, and custom sewers	10	Human Services
11-3021	Computer and information systems managers	11	Information Technology
15-1021	Computer programmers	11	Information Technology
15-1031	Computer software engineers, applications	11	Information Technology
15-1032	Computer software engineers, systems software	11	Information Technology
15-1041	Computer support specialists	11	Information Technology
15-1051	Computer systems analysts	11	Information Technology

APPENDIX A: List of Occupations and Career Clusters (continued)

15-1061	Database administrators	11	Information Technology
15-1071	Network and computer systems administrators	11	Information Technology
15-1081	Network systems and data communications analysts	11	Information Technology
15-1099	Computer specialists, all other	11	Information Technology
13-1061	Emergency management specialists	12	Law, Public safety, corrections and security
19-4092	Forensic science technicians	12	Law, Public safety, corrections and security
21-1029	Social workers, all other	12	Law, Public safety, corrections and security
21-1092	Probation officers and correctional treatment specialists	12	Law, Public safety, corrections and security
23-1011	Lawyers	12	Law, Public safety, corrections and security
23-1021	Administrative law judges, adjudicators, and hearing officers	12	Law, Public safety, corrections and security
23-1022	Arbitrators, mediators, and conciliators	12	Law, Public safety, corrections and security
23-1023	Judges, magistrate judges, and magistrates	12	Law, Public safety, corrections and security
23-2011	Paralegals and legal assistants	12	Law, Public safety, corrections and security
23-2092	Law clerks	12	Law, Public safety, corrections and security
23-2099	Legal support workers, all other	12	Law, Public safety, corrections and security
29-2041	Emergency medical technicians and paramedics	12	Law, Public safety, corrections and security
33-1011	First-line supervisors/managers of correctional officers	12	Law, Public safety, corrections and security
33-1012	First-line supervisors/managers of police and detectives	12	Law, Public safety, corrections and security
33-1021	First-line supervisors/managers of fire fighting and prevention workers	12	Law, Public safety, corrections and security
33-1099	First-line supervisors/managers, protective service workers, all other	12	Law, Public safety, corrections and security
33-2011	Fire fighters	12	Law, Public safety, corrections and security
33-2021	Fire inspectors and investigators	12	Law, Public safety, corrections and security
33-2022	Forest fire inspectors and prevention specialists	12	Law, Public safety, corrections and security
33-3011	Bailiffs	12	Law, Public safety, corrections and security
33-3012	Correctional officers and jailers	12	Law, Public safety, corrections and security
33-3041	Parking enforcement workers	12	Law, Public safety, corrections and security
33-3051	Police and sheriff's patrol officers	12	Law, Public safety, corrections and security
33-3052	Transit and railroad police	12	Law, Public safety, corrections and security
33-9011	Animal control workers	12	Law, Public safety, corrections and security
33-9021	Private detectives and investigators	12	Law, Public safety, corrections and security
33-9031	Gaming surveillance officers and gaming investigators	12	Law, Public safety, corrections and security
33-9032	Security guards	12	Law, Public safety, corrections and security
33-9091	Crossing guards	12	Law, Public safety, corrections and security
33-9092	Lifeguards, ski patrol, and other recreational protective service workers	12	Law, Public safety, corrections and security
33-9099	Protective service workers, all other	12	Law, Public safety, corrections and security
43-5031	Police, fire, and ambulance dispatchers	12	Law, Public safety, corrections and security
11-3051	Industrial production managers	13	Manufacturing
13-1023	Purchasing agents, except wholesale, retail, and farm products	13	Manufacturing
17-3026	Industrial engineering technicians	13	Manufacturing
17-3027	Mechanical engineering technicians	13	Manufacturing
43-5061	Production, planning, and expediting clerks	13	Manufacturing
43-5111	Weighers, measurers, checkers, and samplers, recordkeeping	13	Manufacturing
47-2011	Boilermakers	13	Manufacturing
49-1011	First-line supervisors/managers of mechanics, installers, and repairers	13	Manufacturing
49-2011	Computer, automated teller, and office machine repairers	13	Manufacturing
49-2021	Radio mechanics	13	Manufacturing
49-2022	Telecommunications equipment installers and repairers, except line installers	13	Manufacturing
49-2092	Electric motor, power tool, and related repairers	13	Manufacturing
49-2094	Electrical and electronics repairers, commercial and industrial equipment	13	Manufacturing
49-2097	Electronic home entertainment equipment installers and repairers	13	Manufacturing
49-2098	Security and fire alarm systems installers	13	Manufacturing
49-3053	Outdoor power equipment and other small engine mechanics	13	Manufacturing
49-9041	Industrial machinery mechanics	13	Manufacturing
49-9042	Maintenance and repair workers, general	13	Manufacturing
49-9043	Maintenance workers, machinery	13	Manufacturing
49-9044	Millwrights	13	Manufacturing
49-9062	Medical equipment repairers	13	Manufacturing
49-9063	Musical instrument repairers and tuners	13	Manufacturing
49-9064	Watch repairers	13	Manufacturing
49-9069	Precision instrument and equipment repairers, all other	13	Manufacturing

APPENDIX A: List of Occupations and Career Clusters (continued)

49-9091	Coin, vending, and amusement machine servicers and repairers	13	Manufacturing
49-9093	Fabric menders, except garment	13	Manufacturing
49-9094	Locksmiths and safe repairers	13	Manufacturing
51-1011	First-line supervisors/managers of production and operating workers	13	Manufacturing
51-2011	Aircraft structure, surfaces, rigging, and systems assemblers	13	Manufacturing
51-2021	Coil winders, tapers, and finishers	13	Manufacturing
51-2022	Electrical and electronic equipment assemblers	13	Manufacturing
51-2023	Electromechanical equipment assemblers	13	Manufacturing
51-2031	Engine and other machine assemblers	13	Manufacturing
51-2091	Fiberglass laminators and fabricators	13	Manufacturing
51-2092	Team assemblers	13	Manufacturing
51-2093	Timing device assemblers, adjusters, and calibrators	13	Manufacturing
51-2099	Assemblers and fabricators, all other	13	Manufacturing
51-4011	Computer-controlled machine tool operators, metal and plastic	13	Manufacturing
51-4012	Numerical tool and process control programmers	13	Manufacturing
51-4021	Extruding and drawing machine setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4022	Forging machine setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4023	Rolling machine setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4031	Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4032	Drilling and boring machine tool setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4033	Grinding, lapping, polishing, and buffing machine tool setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4034	Lathe and turning machine tool setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4035	Milling and planing machine setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4041	Machinists	13	Manufacturing
51-4051	Metal-refining furnace operators and tenders	13	Manufacturing
51-4052	Pourers and casters, metal	13	Manufacturing
51-4061	Model makers, metal and plastic	13	Manufacturing
51-4062	Patternmakers, metal and plastic	13	Manufacturing
51-4071	Foundry mold and coremakers	13	Manufacturing
51-4072	Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4081	Multiple machine tool setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4111	Tool and die makers	13	Manufacturing
51-4121	Welders, cutters, solderers, and brazers	13	Manufacturing
51-4122	Welding, soldering, and brazing machine setters, operators, and tenders	13	Manufacturing
51-4191	Heat treating equipment setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4192	Lay-out workers, metal and plastic	13	Manufacturing
51-4193	Plating and coating machine setters, operators, and tenders, metal and plastic	13	Manufacturing
51-4194	Tool grinders, filers, and sharpeners	13	Manufacturing
51-4199	Metal workers and plastic workers, all other	13	Manufacturing
51-6031	Sewing machine operators	13	Manufacturing
51-6041	Shoe and leather workers and repairers	13	Manufacturing
51-6042	Shoe machine operators and tenders	13	Manufacturing
51-6051	Sewers, hand	13	Manufacturing
51-6061	Textile bleaching and dyeing machine operators and tenders	13	Manufacturing
51-6062	Textile cutting machine setters, operators, and tenders	13	Manufacturing
51-6063	Textile knitting and weaving machine setters, operators, and tenders	13	Manufacturing
51-6064	Textile winding, twisting, and drawing out machine setters, operators, and tenders	13	Manufacturing
51-6091	Extruding and forming machine setters, operators, and tenders, synthetic and glass fibers	13	Manufacturing
51-6092	Fabric and apparel patternmakers	13	Manufacturing
51-6093	Upholsterers	13	Manufacturing
51-6099	Textile, apparel, and furnishings workers, all other	13	Manufacturing
51-7011	Cabinetmakers and bench carpenters	13	Manufacturing
51-7021	Furniture finishers	13	Manufacturing
51-7031	Model makers, wood	13	Manufacturing
51-7042	Woodworking machine setters, operators, and tenders, except sawing	13	Manufacturing
51-7099	Woodworkers, all other	13	Manufacturing
51-8011	Nuclear power reactor operators	13	Manufacturing
51-8012	Power distributors and dispatchers	13	Manufacturing

APPENDIX A: List of Occupations and Career Clusters (continued)

51-8013	Power plant operators	13	Manufacturing
51-8091	Chemical plant and system operators	13	Manufacturing
51-8099	Plant and system operators, all other	13	Manufacturing
51-9011	Chemical equipment operators and tenders	13	Manufacturing
51-9021	Crushing, grinding, and polishing machine setters, operators, and tenders	13	Manufacturing
51-9022	Grinding and polishing workers, hand	13	Manufacturing
51-9023	Mixing and blending machine setters, operators, and tenders	13	Manufacturing
51-9031	Cutters and trimmers, hand	13	Manufacturing
51-9032	Cutting and slicing machine setters, operators, and tenders	13	Manufacturing
51-9041	Extruding, forming, pressing, and compacting machine setters, operators, and tenders	13	Manufacturing
51-9051	Furnace, kiln, oven, drier, and kettle operators and tenders	13	Manufacturing
51-9061	Inspectors, testers, sorters, samplers, and weighers	13	Manufacturing
51-9071	Jewelers and precious stone and metal workers	13	Manufacturing
51-9082	Medical appliance technicians	13	Manufacturing
51-9111	Packaging and filling machine operators and tenders	13	Manufacturing
51-9121	Coating, painting, and spraying machine setters, operators, and tenders	13	Manufacturing
51-9122	Painters, transportation equipment	13	Manufacturing
51-9123	Painting, coating, and decorating workers	13	Manufacturing
51-9131	Photographic process workers	13	Manufacturing
51-9132	Photographic processing machine operators	13	Manufacturing
51-9141	Semiconductor processors	13	Manufacturing
51-9191	Cementing and gluing machine operators and tenders	13	Manufacturing
51-9192	Cleaning, washing, and metal pickling equipment operators and tenders	13	Manufacturing
51-9193	Cooling and freezing equipment operators and tenders	13	Manufacturing
51-9194	Etchers and engravers	13	Manufacturing
51-9195	Molders, shapers, and casters, except metal and plastic	13	Manufacturing
51-9196	Paper goods machine setters, operators, and tenders	13	Manufacturing
51-9197	Tire builders	13	Manufacturing
51-9198	Helpers--Production workers	13	Manufacturing
51-9199	Production workers, all other	13	Manufacturing
53-7063	Machine feeders and offbearers	13	Manufacturing
13-1022	Wholesale and retail buyers, except farm products	14	Marketing, sales and Service
27-1022	Fashion designers	14	Marketing, sales and Service
27-1023	Floral designers	14	Marketing, sales and Service
27-1026	Merchandise displayers and window trimmers	14	Marketing, sales and Service
41-1012	First-line supervisors/managers of non-retail sales workers	14	Marketing, sales and Service
41-2011	Cashiers, except gaming	14	Marketing, sales and Service
41-2021	Counter and rental clerks	14	Marketing, sales and Service
41-2031	Retail salespersons	14	Marketing, sales and Service
41-3099	Sales representatives, services, all other	14	Marketing, sales and Service
41-4011	Sales representatives, wholesale and manufacturing, technical and scientific products	14	Marketing, sales and Service
41-4012	Sales representatives, wholesale and manufacturing, except technical and scientific products	14	Marketing, sales and Service
41-9011	Demonstrators and product promoters	14	Marketing, sales and Service
41-9012	Models	14	Marketing, sales and Service
41-9021	Real estate brokers	14	Marketing, sales and Service
41-9022	Real estate sales agents	14	Marketing, sales and Service
41-9031	Sales engineers	14	Marketing, sales and Service
41-9041	Telemarketers	14	Marketing, sales and Service
41-9091	Door-to-door sales workers, news and street vendors, and related workers	14	Marketing, sales and Service
41-9099	Sales and related workers, all other	14	Marketing, sales and Service
43-3061	Procurement clerks	14	Marketing, sales and Service
43-4051	Customer service representatives	14	Marketing, sales and Service
43-4151	Order clerks	14	Marketing, sales and Service
43-9061	Office clerks, general	14	Marketing, sales and Service
53-6021	Parking lot attendants	14	Marketing, sales and Service
53-6031	Service station attendants	14	Marketing, sales and Service
11-9041	Engineering managers	15	Science, Technology, Engineering and Mathematics
15-1011	Computer and information scientists, research	15	Science, Technology, Engineering and Mathematics

APPENDIX A: List of Occupations and Career Clusters (continued)

15-2021	Mathematicians	15	Science, Technology, Engineering and Mathematics
15-2041	Statisticians	15	Science, Technology, Engineering and Mathematics
15-2091	Mathematical technicians	15	Science, Technology, Engineering and Mathematics
15-2099	Mathematical scientists, all other	15	Science, Technology, Engineering and Mathematics
17-2011	Aerospace engineers	15	Science, Technology, Engineering and Mathematics
17-2021	Agricultural engineers	15	Science, Technology, Engineering and Mathematics
17-2041	Chemical engineers	15	Science, Technology, Engineering and Mathematics
17-2061	Computer hardware engineers	15	Science, Technology, Engineering and Mathematics
17-2071	Electrical engineers	15	Science, Technology, Engineering and Mathematics
17-2072	Electronics engineers, except computer	15	Science, Technology, Engineering and Mathematics
17-2111	Health and safety engineers, except mining safety engineers and inspectors	15	Science, Technology, Engineering and Mathematics
17-2112	Industrial engineers	15	Science, Technology, Engineering and Mathematics
17-2121	Marine engineers and naval architects	15	Science, Technology, Engineering and Mathematics
17-2131	Materials engineers	15	Science, Technology, Engineering and Mathematics
17-2141	Mechanical engineers	15	Science, Technology, Engineering and Mathematics
17-2151	Mining and geological engineers, including mining safety engineers	15	Science, Technology, Engineering and Mathematics
17-2161	Nuclear engineers	15	Science, Technology, Engineering and Mathematics
17-2171	Petroleum engineers	15	Science, Technology, Engineering and Mathematics
17-2199	Engineers, all other	15	Science, Technology, Engineering and Mathematics
17-3011	Architectural and civil drafters	15	Science, Technology, Engineering and Mathematics
17-3012	Electrical and electronics drafters	15	Science, Technology, Engineering and Mathematics
17-3023	Electrical and electronic engineering technicians	15	Science, Technology, Engineering and Mathematics
17-3024	Electro-mechanical technicians	15	Science, Technology, Engineering and Mathematics
17-3029	Engineering technicians, except drafters, all other	15	Science, Technology, Engineering and Mathematics
17-3031	Surveying and mapping technicians	15	Science, Technology, Engineering and Mathematics
19-1021	Biochemists and biophysicists	15	Science, Technology, Engineering and Mathematics
19-1022	Microbiologists	15	Science, Technology, Engineering and Mathematics
19-1029	Biological scientists, all other	15	Science, Technology, Engineering and Mathematics
19-1031	Conservation scientists	15	Science, Technology, Engineering and Mathematics
19-1099	Life scientists, all other	15	Science, Technology, Engineering and Mathematics

APPENDIX A: List of Occupations and Career Clusters (continued)

19-2011	Astronomers	15	Science, Technology, Engineering and Mathematics
19-2012	Physicists	15	Science, Technology, Engineering and Mathematics
19-2021	Atmospheric and space scientists	15	Science, Technology, Engineering and Mathematics
19-2031	Chemists	15	Science, Technology, Engineering and Mathematics
19-2032	Materials scientists	15	Science, Technology, Engineering and Mathematics
19-2041	Environmental scientists and specialists, including health	15	Science, Technology, Engineering and Mathematics
19-2042	Geoscientists, except hydrologists and geographers	15	Science, Technology, Engineering and Mathematics
19-2043	Hydrologists	15	Science, Technology, Engineering and Mathematics
19-2099	Physical scientists, all other	15	Science, Technology, Engineering and Mathematics
19-3021	Market research analysts	15	Science, Technology, Engineering and Mathematics
19-3022	Survey researchers	15	Science, Technology, Engineering and Mathematics
19-3091	Anthropologists and archeologists	15	Science, Technology, Engineering and Mathematics
19-3092	Geographers	15	Science, Technology, Engineering and Mathematics
19-3093	Historians	15	Science, Technology, Engineering and Mathematics
19-3094	Political scientists	15	Science, Technology, Engineering and Mathematics
19-4011	Agricultural and food science technicians	15	Science, Technology, Engineering and Mathematics
19-4021	Biological technicians	15	Science, Technology, Engineering and Mathematics
19-4031	Chemical technicians	15	Science, Technology, Engineering and Mathematics
19-4051	Nuclear technicians	15	Science, Technology, Engineering and Mathematics
19-4061	Social science research assistants	15	Science, Technology, Engineering and Mathematics
19-4099	Life, physical, and social science technicians, all other	15	Science, Technology, Engineering and Mathematics
27-3042	Technical writers	15	Science, Technology, Engineering and Mathematics
11-3071	Transportation, storage, and distribution managers	16	Transportation, Distribution and Logistics
13-1081	Logisticians	16	Transportation, Distribution and Logistics
17-3021	Aerospace engineering and operations technicians	16	Transportation, Distribution and Logistics
39-6031	Flight attendants	16	Transportation, Distribution and Logistics
43-3021	Billing and posting clerks and machine operators	16	Transportation, Distribution and Logistics
43-5011	Cargo and freight agents	16	Transportation, Distribution and Logistics
43-5032	Dispatchers, except police, fire, and ambulance	16	Transportation, Distribution and Logistics
43-5071	Shipping, receiving, and traffic clerks	16	Transportation, Distribution and Logistics
47-4061	Rail-track laying and maintenance equipment operators	16	Transportation, Distribution and Logistics
49-2091	Avionics technicians	16	Transportation, Distribution and Logistics
49-2093	Electrical and electronics installers and repairers, transportation equipment	16	Transportation, Distribution and Logistics
49-2096	Electronic equipment installers and repairers, motor vehicles	16	Transportation, Distribution and Logistics
49-3011	Aircraft mechanics and service technicians	16	Transportation, Distribution and Logistics
49-3021	Automotive body and related repairers	16	Transportation, Distribution and Logistics
49-3022	Automotive glass installers and repairers	16	Transportation, Distribution and Logistics
49-3023	Automotive service technicians and mechanics	16	Transportation, Distribution and Logistics

APPENDIX A: List of Occupations and Career Clusters (continued)

49-3031	Bus and truck mechanics and diesel engine specialists	16	Transportation, Distribution and Logistics
49-3042	Mobile heavy equipment mechanics, except engines	16	Transportation, Distribution and Logistics
49-3043	Rail car repairers	16	Transportation, Distribution and Logistics
49-3051	Motorboat mechanics	16	Transportation, Distribution and Logistics
49-3052	Motorcycle mechanics	16	Transportation, Distribution and Logistics
49-3091	Bicycle repairers	16	Transportation, Distribution and Logistics
49-3092	Recreational vehicle service technicians	16	Transportation, Distribution and Logistics
49-3093	Tire repairers and changers	16	Transportation, Distribution and Logistics
49-9097	Signal and track switch repairers	16	Transportation, Distribution and Logistics
53-1011	Aircraft cargo handling supervisors	16	Transportation, Distribution and Logistics
53-1021	First-line supervisors/managers of helpers, laborers, and material movers, hand	16	Transportation, Distribution and Logistics
53-1031	First-line supervisors/managers of transportation and material-moving machine and vehicle operators	16	Transportation, Distribution and Logistics
53-2011	Airline pilots, copilots, and flight engineers	16	Transportation, Distribution and Logistics
53-2012	Commercial pilots	16	Transportation, Distribution and Logistics
53-2021	Air traffic controllers	16	Transportation, Distribution and Logistics
53-2022	Airfield operations specialists	16	Transportation, Distribution and Logistics
53-3011	Ambulance drivers and attendants, except emergency medical technicians	16	Transportation, Distribution and Logistics
53-3021	Bus drivers, transit and intercity	16	Transportation, Distribution and Logistics
53-3022	Bus drivers, school	16	Transportation, Distribution and Logistics
53-3032	Truck drivers, heavy and tractor-trailer	16	Transportation, Distribution and Logistics
53-3033	Truck drivers, light or delivery services	16	Transportation, Distribution and Logistics
53-3041	Taxi drivers and chauffeurs	16	Transportation, Distribution and Logistics
53-3099	Motor vehicle operators, all other	16	Transportation, Distribution and Logistics
53-4019	Locomotive engineers and operators	16	Transportation, Distribution and Logistics
53-4021	Railroad brake, signal, and switch operators	16	Transportation, Distribution and Logistics
53-4031	Railroad conductors and yardmasters	16	Transportation, Distribution and Logistics
53-4041	Subway and streetcar operators	16	Transportation, Distribution and Logistics
53-4099	Rail transportation workers, all other	16	Transportation, Distribution and Logistics
53-5011	Sailors and marine oilers	16	Transportation, Distribution and Logistics
53-5021	Captains, mates, and pilots of water vessels	16	Transportation, Distribution and Logistics
53-5022	Motorboat operators	16	Transportation, Distribution and Logistics
53-5031	Ship engineers	16	Transportation, Distribution and Logistics
53-6011	Bridge and lock tenders	16	Transportation, Distribution and Logistics
53-6041	Traffic technicians	16	Transportation, Distribution and Logistics
53-6099	Transportation workers, all other	16	Transportation, Distribution and Logistics
53-7051	Industrial truck and tractor operators	16	Transportation, Distribution and Logistics
53-7061	Cleaners of vehicles and equipment	16	Transportation, Distribution and Logistics
53-7062	Laborers and freight, stock, and material movers, hand	16	Transportation, Distribution and Logistics
53-7064	Packers and packagers, hand	16	Transportation, Distribution and Logistics
53-7121	Tank car, truck, and ship loaders	16	Transportation, Distribution and Logistics
53-7199	Material moving workers, all other	16	Transportation, Distribution and Logistics

Source: DTI Associates, Inc. under contract no. ED-04-CO-0121/0001 with U.S. Department of Education, OVAE
Compiled by Don Hilber, based on other tables authored by Richard Dempsey

CAREER CLUSTERS

is comprised of a full report, a state report and an executive summary.
All can be accessed at cew.georgetown.edu/clusters.

GEORGETOWN UNIVERSITY



Center

on **Education**

and the **Workforce**

3300 Whitehaven Street, NW
Suite 5000
Washington, DC 20007

Mail: Campus Box 571444
Washington, DC 20057

cew.georgetown.edu